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GOVERNMENT OF THE PROVINCE OF ALBERTA

OIL AND GAS CONSERVATION BOARD

REPORT TO

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THE LIEUTENANT GOVERNOR IN COUNCIL

With Respect to the Applications
Under
The Gas Resources Preservation Act, 1956 of:

Alberta and Southern Gas Co. Ltd.

Saskatchewan Power Corporation

Trans-Canada Pipe Lines Limited

Westcoast Transmission Company Limited

December, 1959

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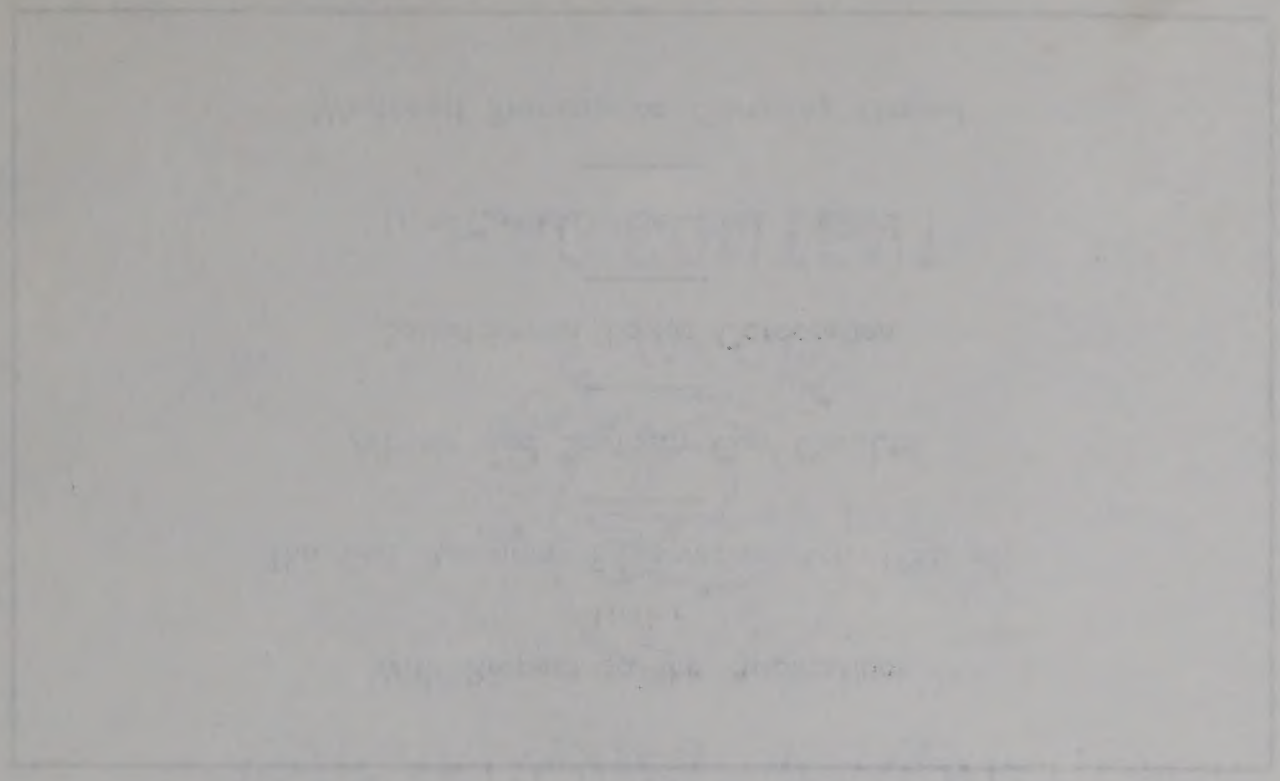

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I N T R O D U C T I O N

During October and November, 1959, this Board heard applications under The Gas Resources Preservation Act, 1956, by Trans-Canada Pipe Lines Limited (herein called "Trans-Canada"), Alberta and Southern Gas Co. Ltd. (herein called "Alberta and Southern"), Saskatchewan Power Corporation (herein called "Saskatchewan Power") and Westcoast Transmission Company Limited (herein called "Westcoast"). Each asked for permission to remove additional volumes of gas from the Province. The Board respectfully submits herewith its report on the applications.

These applications may be conveniently discussed in the one report, as much because of the shortness of the period within which all were received and heard as because of some problems to be considered that are common to two or more applications.

Details of the applications follow.

THE APPLICATION OF
TRANS-CANADA PIPE LINES LIMITED

The application of Trans-Canada Pipe Lines Limited was heard by the Board on October 13th and 14th last.

Trans-Canada is presently the holder of two permits under The Gas Resources Preservation Acts - Permit No. TC 54-1, granted May 14, 1954, and authorizing removal from the Province of gas produced from certain fields listed in the permit, and Permit No. TC 59-2, granted January 29, 1959, and authorizing removal from the Province of gas produced from certain other pools, fields and areas listed in the permit. In its application, as amended at the hearing, Trans-Canada asked:

1. With respect to Permit No. TC 54-1, for amendment of the permit to increase the maximum daily volume of gas that may be removed from the Province from 650 million cubic feet to 680 million cubic feet;

2. With respect to Permit No. TC 59-2, for amendment of the permit

   (a) to change the finding in the "whereas clauses" that the permittee intends to cause the gas to be removed to serve its immediately contractable Canadian requirements outside Alberta, and

   (b) to increase the volumes of gas that may be removed from the Province from 210 million cubic feet to 270 million cubic feet per day, from 70 billion to 90 billion cubic feet per year and from 1,320

billion to 1,700 billion cubic feet during the term of the permit;

3. For the granting of a new permit authorizing the removal from the Province of the additional volumes of gas of 60 million cubic feet per day, 20 billion cubic feet per year and 335 billion cubic feet during a term running from date of issue to May 14, 1981, such gas to be obtained from the Clive North, Enchant, Minnehik, Sedalia, Wimborne, Wood River and Three Hills Creek fields.

The applicant now operates a pipe line extending east from a gate, or point of interconnection with the line of The Alberta Gas Trunk Line Company Limited (herein called "Trunk Line"), within the Province and near the Alberta-Saskatchewan boundary. The Trans-Canada pipe line extends approximately 2,300 miles across Canada to a point near Montreal, Quebec. Evidence was given of plans to increase the capacity of the line to handle additional volumes of gas and to construct a large diameter pipe line extending south from a point on the present line near Winnipeg to a point on the international boundary at or near Emerson, Manitoba, for the purpose of supplying gas to Midwestern Gas Transmission Company (herein called "Midwestern"). Evidence was also given that if the application is granted the additional volumes of gas will be transported by Trunk Line for Trans-Canada from the fields in which it is produced to the gate near the interprovincial boundary.

Marketing of Gas to Midwestern

In its application Trans-Canada showed market requirements of 6,710 billion cubic feet. Its present permits authorize the removal from the Province of 5,870 billion cubic feet. To meet the deficiency of 840 billion cubic feet, Trans-Canada proposes to obtain permission to remove 700 billion cubic feet through the present application and to obtain the balance in Saskatchewan by purchase from the Saskatchewan Power Corporation. (That the Saskatchewan purchases would be made possible by gas produced in Alberta is shown by the Saskatchewan Power application discussed elsewhere in this report.)

The additional market requirements shown at this time arise from a series of contracts and letter agreements made over the past four years by Trans-Canada, Tennessee Gas Transmission Company and Midwestern.. Tennessee Gas Transmission Company has assigned the rights and obligations acquired by it in the original agreement to Midwestern. The agreement is subject to each party obtaining the certificates, licences and permits required by law and, as at the time of the hearing, provided for the sale by Trans-Canada and purchase by Midwestern, at Emerson, of gas at the rate of 200 million cubic feet per day. Certain options, not material here, have been granted to one another by the parties. The period allowed to parties for the obtaining of the necessary certificates, licences and permits has been extended by agreement from time to time, but at the time of the hearing, would terminate on November 1, 1959, after which either party could give notice of its intent to discontinue

the agreement. Mr. N. John McNeill, a vice-president and secretary of Trans-Canada, appearing as a witness expressed the hope that the required authorizations would be obtained in the course of the next few months, possibly by the end of January. He was not in a position to state that a notice of termination would not be given by one of the contracting parties, but was inclined to discount the danger of such termination. He referred to Midwestern's action in asking the Federal Power Commission for a permit conditioned upon Canadian authorizations being obtained within a reasonable time and to the possibility of nullifying a notice of termination by the acquisition of the authorizations during its thirty day-period.

Provision for Needs within Province and Other Canadian Markets

The Trans-Canada application referred to the report on applications by Alberta and Southern and Westcoast which the Board submitted in March of 1959. Table D-3 to that report demonstrated how the future requirements of Alberta could be met for the thirty-year period ending December 31, 1988. Trans-Canada concurs with this.

In the submissions supporting its application, Trans-Canada presented schedules of its market requirements to and including the year 1980. Comparing its predicted Canadian sales for the period from 1959 to 1980 with forecasts for this market presented by Trans-Canada at earlier hearings, it was pointed out that at the Alberta and Southern hearing in 1958 Trans-Canada foresaw sales totalling 10.353 trillion cubic feet of gas. At the Trans-Canada hearing in January, 1959, the volume of

sales predicted by the applicant was 5.850 trillion cubic feet and in the present application the predicted volume of sales is 5.258 trillion cubic feet. In explanation of the decrease, Mr. Saks, Trans-Canada's Sales Manager, stated that the last estimate was made after a year of operation with attachment of all potential customers but the Ontario Storage Company and after careful check with Trans-Canada's customer companies.

In the report of September, 1958, made after the Alberta and Southern hearing above referred to and the hearing of a Westcoast application then under consideration, the Board stated:

> The Board considers that Canadian requirements beyond the Province and within the range of economic feasibility should be protected for twenty-five years and that this can be achieved by the reservation of the immediately contractable future requirements from current established reserves and the reservation of the balance of the requirements from future reserves.

and further:

> Such reservation (of some 1.7 trillion cubic feet, in addition to what was under permit, of established gas reserves from surplus declaration) has been made and will be continued until December 31, 1958, to afford Trans-Canada Pipe Lines Limited the opportunity to contract for the gas and to file an application ----------

It is clear that the contractable requirements of Trans-Canada's Canadian market that have been protected are those requirements for which it is possible and practical to contract for the purchase of gas, and not those for which a firm sales contract can be immediately made.

Gas Supplies

The applicant gave evidence of contracts and letters of intent covering the volumes of gas which it would purchase from producers and which it seeks permission to remove from the Province.

Trans-Canada in its tabulation shows volumes increasing yearly until 1962-63. Mr. Horte, Trans-Canada's manager of gas supply, explained these calculations in his evidence. He stated that, by reasons of its contracts and the letters of intent, Trans-Canada would be entitled to purchase gas in the year 1962-63 and thereafter at a maximum daily rate of 983,935 thousand cubic feet. He said this volume was not adjusted to a common heating value.

The gas supply contracts produced in support of earlier applications by Trans-Canada have been discussed in earlier reports. The recent contracts now produced are very similar in form, but having three main differences. Firstly, the new contracts are made conditional upon the obtaining of the necessary authorizations for the export of gas by Trans-Canada to the United States. Also, the initial price has been increased from $13\frac{1}{4}$ cents to $13\frac{1}{2}$ cents per thousand cubic feet, and escalates to 21 cents by July 1, 1983. While in the earlier contracts the take or pay volumes built up over the first four years, in the new contract the full amount applies from the start. There are also minor variations in the provisions for renegotiation of price.

Interveners

The following registered as interested parties at the hearing:

Counsel or Representative	Representing
John Maybin	Canadian Western Natural Gas Company Limited and Northwestern Utilities, Limited
S. J. Helman, Q.C.	City of Calgary
J. E. Prothroe	Westcoast Transmission Company Limited
R. L. Winton	Alberta and Southern Gas Co. Ltd.
A. D. Bessemer, Q.C.	The Alberta Gas Trunk Line Company Limited

Mr. Bessemer adduced evidence supporting Trans-Canada's application, Mr. Helman was active in cross-examination of the applicant's witnesses, Mr. Maybin asked one question of the witness, Horte, and the rest of the interveners took no active part in the hearing.

Trunk Line's witnesses described the pipe line and related facilities of its Plain's Division that would be used to transport Trans-Canada's gas to the gate near the Alberta-Saskatchewan boundary, and stated that Trunk Line would be prepared to construct the pipe line facilities described and to transport the additional volumes of gas referred to in Trans-Canada's application.

Mr. Helman, appearing for the City of Calgary, directed his cross-examination toward problems arising from Trans-Canada's contracts and the price structures appearing therein.

His concern related to the contract between Trans-Canada and the Alberta utilities, described in detail in the Board's report of January 28, 1959, under which the utilities would pay for gas purchased by the utilities from Trans-Canada on the basis of the weighted average field price paid by Trans-Canada. If the price paid in the fields by Trans-Canada was increased on a redetermination arising from a reduction in price to Midwestern or from the earning of greater profits by Trans-Canada than those anticipated in the contract, then the result would be an increase in the price to the Alberta utilities. The Board in its January, 1959, report considered the agreement between Alberta utilities and Trans-Canada and was unable to find it unreasonable or against the public interest.

THE APPLICATION OF ALBERTA AND SOUTHERN GAS CO. LTD.

The application of Alberta and Southern was heard on October 22nd and 23rd, 1959.

Permit No. AS 59-1, under The Gas Resources Preservation Act, 1956, had been granted the applicant on April 7, 1959. Under it the applicant may acquire gas from pools, fields and areas named in the permit and cause it to be removed from the Province through a series of lines extending southward to California and through a separate line to Montana.

In the present application, Alberta and Southern asks for amendment of Permit No. AS 59-1. The applicant requests that the volumes of and maximum rates at which gas may be removed from the Province be increased from 400 million to 500 million cubic feet per day, from 135 billion to 168 billion cubic feet in a consecutive twelve-month period, and from 2,300 billion to 4,200 billion cubic feet during the term of the permit. Alberta and Southern also asks that there be added to the schedule of pools, fields and areas in the permit the Brazeau River, Burnt Timber, Caroline, Fox Creek, Fox Creek North, Fox Creek West, Kaybob and Lobstick fields or areas. Further the applicant requests that the termination date of the permit be changed from February 29, 1984, to twenty-five years after the date of the effective commencement of the removal of gas from the Province pursuant to the permit. Alberta and Southern also asks that there be added in the permit "a proviso to the effect that the Applicant shall not draw the remaining reserves of gas in

the pools, fields and areas scheduled in the said Permit below the volume the Board determines should be reserved therefrom for the protection of Alberta consumers, less any quantities delivered by the Applicant for use within the Province of Alberta during the term of the said Permit, except upon further application to and subject to further authorization from the Board; and by specifying in the proviso the method by which the foregoing reservation of gas is to be prorated among the pools, fields and areas under the said Permit, as amended.".

The Alberta and Southern project was described in earlier reports by the Board and remains unchanged with respect to market studies, economic feasibility, pipe line design or route selection, financing or the provision of gas for needs within the Province in accordance with the agreement between Alberta and Southern and the Alberta utilities. Mr. C. P. Smith, the Manager and Vice-President of the applicant company, stated that Alberta and Southern was prepared to proceed with its project, irrespective of whether Westcoast went ahead with its project. He stated that if it is possible to take full advantage of the 1960 construction season, then the project may be placed in operation late in 1961.

In discussing the proposed addition of the proviso set out above, Mr. Smith stated that from a practical business point of view for Alberta and Southern and its producers it is important that they know what part of the reserves in a field might be called upon to supply local requirements and how much of that part had, at any time, been already taken. He

added that if the Board concludes, as Alberta and Southern believes, that there is ample gas to cover fully the protection required by Alberta and to permit the volume of export asked for by the applicant, then there would be no need for the provision.

Alberta and Southern offered no direct evidence as to the need or desirability of the amendment applied for regarding the term of the permit. Cross-examination of Mr. Smith on the proposed amendment was confined to discussion of how the resulting term of the permit would compare with the term of a licence that might be granted under the National Energy Board Act, and this was necessarily inconclusive as regulations under Part VI of that Act had not been established at the time of the hearing.

Evidence was given by the applicant regarding contracts, letters of agreement and options, made since the last Alberta and Southern hearing, under which Alberta and Southern may purchase gas from producers in six fields or areas, including Brazeau River and Kaybob which are not among those listed in the permit. Brazeau River is a new discovery and Alberta and Southern has agreements with three of the four operators and is negotiating with the fourth. About 80 per cent of the reserves in the Kaybob Field are covered by Alberta and Southern contracts. Evidence was given by Alberta and Southern at earlier hearings concerning contracts for gas to be produced from other fields and areas which the applicant asks to have added to the schedule in the permit, Caroline, Fox Creek North, Fox Creek West, Lobstick and Burnt Timber.

Reserve Appreciation

An important part of Alberta and Southern's submissions in support of its requestt for permission to remove greater volumes of gas is the study of "Reserve Appreciation" by S. R. Blair which is discussed in Appendix B of this report.

Interveners

The following registered as interested parties at the hearing:

Counsel or Representative	Representing
S. J. Helman, Q.C.	City of Calgary
G. H. Steer, Q.C.	Canadian Western Natural Gas Company Limited and Northwestern Utilities, Limited
J. H. Laycraft	Calgary Power Ltd.
J. E. Prothroe	Westcoast Transmission Company Limited
A. D. Bessemer, Q.C.	The Alberta Gas Trunk Line Company Limited
G. Leslie	Trans-Canada Pipe Lines Limited

The City of Calgary made a submission in which the Board was asked that, in reconsidering the future needs of persons within the Province, it take into account the possible use of gas in the future for the generation of electrical power for the Calgary area. This submission is discussed in detail in Appendix C. At the request of the Board, Calgary Power Ltd. furnished witnesses to comment on the Calgary submission. The witness for Canadian Western Natural Gas Company Limited also discussed the future requirements of the Canadian Western

system in the light of the City's submission.

Mr. Helman was also active in the cross-examination of the applicant's witnesses. He was concerned with the price provisions of the Alberta and Southern contracts, and with the use of Alberta gas in the thermal generation of electricity in California. In replying to Mr. Helman, Mr. Smith stated that some gas might be used in steam generators during the off-peak season to provide the pipe line project with a high load factor. The Board considers such use of gas in off-peak periods is quite reasonable.

The Board in its March, 1959, report considered the agreement between Alberta utilities and Alberta and Southern and was unable to find it unreasonable or against the public interest.

The remaining interveners did not take an active part in the hearing.

THE APPLICATION OF SASKATCHEWAN POWER CORPORATION

The application of Saskatchewan Power Corporation was heard by the Board in Medicine Hat on October 29th and 30th, 1959. Originally it had been scheduled for hearing on October 5th, but the later date was arranged at the request of the counsel for the City of Medicine Hat.

Saskatchewan Power, in its application, asks for amendment of the permit granted to it on August 20, 1957, under the provisions of The Gas Resources Preservation Act, 1956. Increase in the volume and rates of removal of gas is requested to raise the maximum daily rate from 83 million cubic feet to 137.9 million cubic feet, the rate for a period of twelve consecutive months from 18 billion cubic feet to 45.3 billion cubic feet and the total for the term of the permit from 223 billion cubic feet to 720 billion cubic feet. The term of the permit commenced on July 1, 1958, and Saskatchewan Power asks that the length of the term be doubled from twenty years to forty years. The applicant also asks for a redefinition of the area in which gas that may be removed from the Province can be produced. The main effect of the redefinition applied for would be to move the western boundary of the area three miles to the west.

The purpose of the application was discussed by Mr. D. Cass-Beggs, the General Manager of Saskatchewan Power Corporation, in his testimony. Saskatchewan Power has an extensive and expanding system for the distribution of gas throughout

the more populous parts of the Province of Saskatchewan. Mr. Cass-Beggs now wishes to obtain an assured supply of gas to serve the system for a thirty-year period. The requirement for this is some 1,500 billion cubic feet. Of this the amount that can be foreseen as definitely available in Saskatchewan is 950 billion cubic feet. The applicant hopes to take from Alberta a maximum volume, during the period of thirty years, of 695 billion cubic feet, of which 145 billion would be sold to Trans-Canada, and the remaining 550 billion added to the Saskatchewan reserve of 950 to make up the Saskatchewan thirty-year requirement of 1,500 billion cubic feet of gas. Mr. Cass-Beggs looks forward to new discoveries in Saskatchewan to cover further expansion. The problem of peaking in the latter part of the thirty-year period will be met by the use of underground storage fields and by the plan of taking gas from Alberta throughout the period but selling to Trans-Canada for only twenty years.

Mr. Cass-Beggs also explained why a forty-year permit is desired, in view of the thirty-year base of his planning. It would enable Saskatchewan Power to get all the gas it is purchasing. Also, it would provide flexibility, so that Saskatchewan Power in a suitable circumstance might defer production from its own acreages in Alberta and produce the gas later.

Gas Supply

Evidence was given by consultants retained by Saskatchewan Power to present an up to date estimate of the reserves in the Medicine Hat and Etzikom gas fields. They also presented an

illustrative deliverability schedule based on the estimate to show how both the future needs of the Medicine Hat-Redcliff area and the proposed withdrawals by Saskatchewan Power could be met.

Heretofore, Saskatchewan Power has acquired gas for the purposes of its permit from two producers in the Medicine Hat Field, Britalta Petroleums Limited and Crescent Oil and Gas Corporation. In the spring of 1959, the applicant made contracts with these two producers under which it is purchasing the leases, wells and equipment, licences and surface rights, rights of way and the like in the part of the Field from which the gas is being produced. The agreements are conditional upon Saskatchewan Power getting a contract for sale of gas to Trans-Canada and upon the success of the subject application, among other things. The agreement gave the applicant until September 1, 1959, to fulfil these prerequisites, and this date was changed by subsequent agreement to January 1, 1960.

The agreement made between Saskatchewan Power and Trans-Canada on May 1 last, was also produced. This agreement provides for sale of gas by Saskatchewan Power to Trans-Canada during a twenty-year term commencing November 1, 1960. The contract volume for the first fifteen years is 17 million cubic feet per day, and this amount is progressively reduced thereafter to 8.5 million cubic feet in the final year. The obligations to sell and to purchase gas are conditional upon the applicant obtaining permission to remove the gas from Alberta by September 1, 1959, and upon Trans-Canada giving

notice to the applicant by March 1, 1960, that necessary authorization for its export of gas to the United States had been obtained. By letter agreement, this first date was subsequently changed to January 1, 1960.

Provincial Requirements

It is submitted by the applicant that the granting of its application will leave ample reserves of gas in the Medicine Hat and Etzikom Fields to fill the future needs of the Medicine Hat-Redcliff area. The deliverability studies presented by the applicant contemplated the supply of some gas for local requirements from the "export areas" in the Medicine Hat Field, and the contracts under which Saskatchewan Power proposes to buy out the interests in the Field of Britalta and Crescent contemplate that the permit for the removal of gas from Alberta, upon which the contracts depend, may contain a reservation of up to 100 billion cubic feet of gas for future sale to Medicine Hat or communities or residents of Alberta.

When Mr. Cass-Beggs was giving evidence he put forward a further proposal to provide a reserve of gas for the City of Medicine Hat. Speaking for the applicant, he offered to sell gas in place to the City, in the amount of 95 billion cubic feet, or such other amount less than 100 billion cubic feet as may be set by the Board, and at the price of $2\frac{1}{2}$ cents per thousand cubic feet. This price is approximately that being paid by Saskatchewan Power for the reserves. The offer was subject to two conditions: firstly, that it be accepted by the end of the year, because otherwise Saskatchewan Power

would be starting to develop the properties; and, secondly, that it be accepted by the City as full settlement of any claim it might have to be supplied with gas from the Saskatchewan Power area. Subsequent to the hearing, Mr. James G. Kidd, counsel for the City, advised the Board that, under The City Act, Medicine Hat did not have sufficient borrowing power to finance the purchase and additional legislative authority would have to be obtained if the proposed sale is to be completed.

Interveners

The following registered as interested parties at the hearing:

Counsel or Representative	Representing
A. B. Beaven	Bailey Selburn Oil & Gas Ltd., Charter Oils Limited and J. Merrill Wright, Jr.
R. R. Mahaffey	The California Standard Company
C. K. Kempston	United Canso Oil and Gas Limited
S. McKinnon	Canadian Delhi Oil Ltd.
F. P. Layton, Q.C.	Trans-Canada Pipe Lines Limited
J. G. Kidd, Q.C.	City of Medicine Hat
H. S. Rowbotham	B. H. Petroleums Limited
G. Sissons	Medicine Hat Brick & Tile Company Limited
R. H. A. Lacey	Medicine Hat Chamber of Commerce
William Rae	Himself

Mr. R. A. MacKimmie, Q.C., counsel for the applicant, appeared also for Britalta Petroleums Limited and Crescent Oil and Gas Corporation.

Submissions were presented by The California Standard Company, Medicine Hat Brick & Tile Company Limited, Medicine Hat Chamber of Commerce and Mr. Rae. Cross-examination of the applicant's witnesses was conducted by Mr. Kidd, Mr. Beaven, Mr. Rowbotham, Mr. Mahaffey and Mr. Kempston and his technical adviser. In addition Mr. Kidd presented argument on behalf of the City.

The California Standard Company supported the Saskatchewan Power application. In its submission, California Standard presented a geological and engineering study of its Medicine Hat reserves, in the Dunmore area of the Field. It proposed also that Saskatchewan Power Corporation should assure the Board that offers, comparable to those made to Britalta Petroleums Limited and Crescent Oil and Gas Corporation, will be made to California Standard and other lease holders of proven gas reserves in the export area.

Medicine Hat Brick & Tile Company Limited opposed any additional gas export from the Medicine Hat Field, and in particular, from that area from which gas will be needed to supply the needs of the City and its industries for at least forty years. The submission pointed out that this intervener and other manufacturers have had plants in the area for forty to fifty years which depend on large volumes of low cost gas, that its gas requirements since the last hearing have exceeded

what was then estimated, and that the recent discovery of an impressive water resource make greater industrial growth at Medicine Hat likely.

The Chamber of Commerce stated that the interests of Medicine Hat should be carefully weighed by the Board and ample provision made for its present and prospective future gas requirements. The submission pointed out that an abundant supply of gas was the basis for Medicine Hat's industrialization and is essential to its growth and continued prosperity. It was pointed out that, during the past year, the Research Council of Alberta has discovered an aquifer twenty feet underground at Police Point in Medicine Hat with a capacity of 1.7 million gallons of water per day, which provides a new attraction to Medicine Hat for industry. An example of continued industrial growth is the recent decision of Goodyear Tire & Rubber Company Ltd. to locate a plant at Medicine Hat.

Mr. William Rae, who is part owner of some mineral rights north of the City of Medicine Hat, again appeared before the Board. His properties are still being drained, he states, by wells on adjacent properties, owned by the City and by Redcliff firms. He submits that the reservation of gas rights, which may be so drained, for the use of a "third party" at a future unspecified time is unreasonable and an invasion of a person's property rights.

City of Medicine Hat

Mr. J. G. Kidd, Q.C., as counsel for the City of Medicine Hat, presented an oral argument concerned in various ways with

the status of the applicant. Acceptance of the argument would require dismissal of the application, irrespective of the merits of the project. Mr. Kidd distinguished the present application from that which preceded the granting of the permit to Saskatchewan Power Corporation on the basis that the applicant now proposed to buy properties in Alberta, whereas before it took delivery of the gas at the border.

The first argument advanced for the City was that Saskatchewan Power is not a person within the meaning of section 5 of The Gas Resources Preservation Act, 1956. That section provides that an application for a permit may be made by a "person who produces gas within the Province, or who purchases or otherwise acquires or has entered into a contract to purchase or otherwise acquire property in gas within the Province, and who intends to remove any part of such gas, or cause it to be removed, from the Province." Referring to The Power Corporation Act (Saskatchewan), Mr. Kidd stated that the applicant can act or hold property only as agent for the Crown in the right of the Province of Saskatchewan and that an emanation from the Crown in the right of a province has no legal status in another province as a province has no extra-territorial jurisdiction. Reference was made to the definitions in The Interpretation Act of "Her Majesty" and "person".

Next Mr. Kidd invited the Board to envisage the situation if Saskatchewan Power held a permit or Alberta leases, and to conclude that it would be an impossible one. He referred to section 13 of The Gas Resources Preservation Act, 1956,

authorizing cancellation of a permit in a suitable case, and sections 22 and 23, the offences and penalties sections, and he said these provisions couldn't be applied against the Crown. The Crown isn't subject to taxation and its rights are not subject to forfeiture. Mr. Kidd referred to judicial decisions where Crown property in the possession of another was held to be tax exempt, and where property of which the Crown was equitable owner and another the legal owner was protected by the privileges of the Crown. In such circumstances, Mr. Kidd suggested, the intent of The Gas Resources Preservation Act, 1956, as recited in section 3, could not be carried out.

Mr. Kidd then argued that if the Province of Saskatchewan cannot pass an act having extra-territorial power, it cannot create a corporation having such power but able to apply it only as agent of the Crown. An agent cannot have more power than his principal. The Province cannot do indirectly what it cannot do directly. The agreements with Britalta and Crescent are, Mr. Kidd submitted, ultra vires. In any event, Saskatchewan Power, by the terms of its Act, cannot make the expenditures required by the contracts without authority of the Lieutenant Governor in Council.

The last argument advanced on behalf of the City dealt more with the evidence. In it, Mr. Kidd submitted that the Board, as an administrative tribunal, should not hear an application to vary a previous decision unless there is a substantial change in circumstances, and he told why in his opinion there was no such substantial change.

Mr. R. A. MacKimmie spoke in rebuttal. He submitted that the Board was not a proper authority to decide on the matters of constitutional law advanced by Mr. Kidd, and said he would be content to have the matters referred by the Board, if it thought necessary, for consideration. However, Mr. MacKimmie pointed out that the applicant is a corporation registered to do business in the Province of Alberta. He said also that Mr. Kidd had not read far enough into The Power Corporation Act, and that Saskatchewan Power was given power therein to contract and to sue and be sued and was made subject in tort to the liabilities of a person of full age and capacity. With regard to Mr. Kidd's last argument, Mr. MacKimmie took the view that there were significant changes since the earlier hearing. He pointed out that The Gas Resources Preservation Act, 1956, authorized a hearing to reconsider a permit, and he stated that the question is not one of jurisdiction but rather one of evaluating the evidence.

THE APPLICATION OF WESTCOAST TRANSMISSION COMPANY LIMITED

The hearing of the application of Westcoast Transmission Company Limited took place on November 16th, 1959.

Westcoast asks for amendment of one of its permits under The Gas Resources Preservation Act, 1956, - Permit No. WC 59-3, granted on April 7, 1959. The amendment applied for would increase the volume of gas that may be removed during the term of the permit from 800 billion cubic feet to 1,100 billion cubic feet.

The application is based on the claim of Westcoast that greater volumes of gas will be available from the Calgary Field. Some of this would come from an increase in the reserve estimate for the Field and Westcoast adduced evidence to support such a re-assessment in the light of data obtained in the further development of the Field. It is also claimed that the processing plant to be built by Jefferson Lake Petrochemicals of Canada, Limited (herein called "Jefferson") would use a different process than originally planned and thus significantly increase the output of pipe line gas.

In support of this latter claim, Westcoast called Donald N. Mills, a process engineer with Ralph M. Parsons Company of Canada Ltd. His company is one of a number who were invited this year to submit process proposals for processing a mixture of Elkton and Crossfield formation gases in the proposed plant. The proposal he presented would use the hot carbonate process for the removal of acid gases, rather than the amine process which

until now has been more widely used. Mr. Mills stated that interest in the hot carbonate process has revived in the past five years, and that it is suitable for a project involving the pressures and volumes of the sour gas to be handled at Jefferson's Calgary plant. The heat required by the hot carbonate process is much less than that required by the amine process, and it was estimated by the witness that a two stage operation, with most of the acid gases being removed by the hot carbonate process would not require the use of more than 15 per cent of the incoming gas for plant fuel, as compared with possibly 35 per cent required for plant fuel with the amine process (depending on the weight of the solution used in the processing).

In accordance with a request made by the Board at the hearing Westcoast subsequently filed a letter from Jefferson which stated that contracts for the plant had not been concluded, but that several firms had submitted proposals employing the hot carbonate process, and that that process would be used.

Gas Supply Contracts

Among the terms and conditions of Permit No. WC 59-2 was the requirement that Westcoast satisfy the Board on or before May 29, 1959, that it had entered into a formal definitive contract with Jefferson for the sale to Westcoast of gas produced in the Calgary Field in volumes substantially in accordance with the letter agreements produced at the hearings of the application for the permit. A satisfactory agreement

was filed with the Board at the required time, and it was also incorporated in Westcoast's submission in support of the present application.

Mobil Oil of Canada, Ltd. as well as Jefferson appears as seller in the Calgary gas purchase agreement. Jefferson's right to the gas reserves arises from a contract with Mobil under which the latter has a reversionary interest in some of the gas. The inclusion of Mobil in the gas purchase agreement makes the title picture clearer and also makes the Mobil's interest in the gas subject to the sale. A total volume of 800 billion cubic feet of gas is made available under the terms of the contract. It is presumed that the gas will be available by the latter part of the year, 1961.

Mr. D. P. McDonald, Vice-President and Managing-Director of Westcoast, in his evidence regarding the gas supply contracts, brought the Savanna Creek contract situation up to date. The Savanna Creek contracts, produced at earlier Westcoast hearings, contained a provision under which they could be terminated after December 31, 1958, if the necessary authorizations to permit export of the gas to the United States had not been obtained. Extension agreements delaying the right to terminate to December 31, 1960, were entered at the hearing. At the same time attention was drawn to a slight change in the price provisions of the contracts, so that the price will escalate in the first two years of operation to the extent that would originally have taken three years.

Interveners

The following registered as interested parties at the hearing:

Counsel or Representative	Representing
B. V. Massie, Q.C.	Canadian Western Natural Gas Company Limited
R. L. Winton	Alberta and Southern Gas Co. Ltd.

They did not take an active part in the hearing.

F I N D I N G S

The Board having publicly heard the applications under The Gas Resources Preservation Act, 1956, of Trans-Canada Pipe Lines Limited, Alberta and Southern Gas Co. Ltd., Saskatchewan Power Corporation and Westcoast Transmission Company Limited, having studied the evidence submitted at the public hearings and having regard to the advice of its staff, to its own knowledge, and to its responsibilities under the Act, finds as follows:

I IN THE MATTER OF THE ESTABLISHED RESERVES OF GAS IN ALBERTA

The Board estimates the established reserves of gas in Alberta as of September 30, 1959, to be 26.9 trillion cubic feet (at 14.4 pounds per square inch absolute and 60 degrees Fahrenheit) or the equivalent of 27.7 trillion cubic feet when converted to a common heating value of 1,000 Btu per cubic foot.

The present estimate represents an increase of some 2.1 trillion cubic feet since the Board's last estimate of December 31, 1958. (9 months) Approximately 604 billion cubic feet of this increase is attributable to new discoveries in Burnt Timber and Lookout Butte and to recent development of the Swan Hills Field which had not been included in the Board's last estimate. Another 100 billion cubic feet, approximately, is attributable to various smaller new discoveries.

The remainder of the increase is due to appreciation of previously reported discoveries. Of the 27.7 trillion cubic feet some 1.3 trillion cubic feet represent reserves presently considered beyond economic reach. Details of the reserve estimate appear in Appendix A.

II IN THE MATTER OF THE TRENDS IN EXPLORATION AND THE GROWTH OF RESERVES OF GAS IN ALBERTA

The relationship previously established between the number of wildcat wells drilled and the new reserves discovered has been further confirmed at 6 to 7 billion cubic feet per wildcat well. Over the past nine years the wildcat activity has varied from 346 to 469 wells per year, resulting in an average overall reserve growth rate of 2.9 trillion cubic feet per year. This rate may be expected to continue. Even if wildcat activity should decrease somewhat a minimum of 2.2 trillion cubic feet per year of reserve growth may be counted upon in the immediate future.

New data and new appraisal of the statistics of the growth of reserves appear in Appendix B. The overall growth of reserves is analyzed to show the portion due to appreciation of presently known reserves, that due to new discoveries, and that due to appreciation of new discoveries. Detailed growth forecast on the basis of a normal and a low expectation are presented. The latter demonstrates that reserves will have increased by 4.4 trillion cubic feet within two years. Of this some 3.0 trillion cubic feet will be due to appreciation of existing reserves, some 1.0 trillion cubic feet to new discoveries and some 0.4 trillion cubic feet to appreciation of new discoveries.

III IN THE MATTER OF THE PRESENT AND FUTURE REQUIREMENTS OF ALBERTA FOR GAS AND THE PRESENT EXPORT COMMITMENTS

The Board estimates the actual requirements for Alberta for gas for the thirty-year period, January 1, 1960, to December 31, 1989, to be 8.4 trillion cubic feet (1,000 Btu basis) with a 1989 peak day requirement of 2.1 billion cubic feet. Present remaining export commitments total some 10.7 trillion cubic feet (1,000 Btu basis).

The Board received extensive evidence concerning the future gas requirements for the generation of electrical power for the Calgary Metropolitan area. In addition, submission and testimony were presented regarding the future requirements for gas for the Medicine Hat-Redcliff area. This evidence is reviewed and analyzed in Appendix C which also contains the details of the revised Board estimate. Full consideration is given to the contention of the City of Calgary that further gas should be reserved for the generation of electrical energy. However, the Board concludes that its previous estimates of total provincial requirements are adequate and need be revised only by advancing the forecast period by one year. In terms of regional requirements within the Province, the Board made minor adjustments, including a slight increase in the requirements for the Medicine Hat-Redcliff area.

IV IN THE MATTER OF THE MEETING OF THE 1960 TO 1989 REQUIREMENTS OF ALBERTA, TOGETHER WITH THE PRESENT EXPORT COMMITMENTS

The Board estimates that gas reserves totalling some 11.7 trillion cubic feet (1,000 Btu basis) are necessary to meet the annual and peak day requirements of Alberta for the thirty-year period, 1960 to 1989.

With the further confirmation of the reliability of the trends in the growth of reserves, the Board now considers that full weight may be given with complete safety to the new reserves which will be developed within the next two to five years. Taking only those reserves estimated on a conservative basis which will be developed by September 30, 1961, 4.4 trillion cubic feet may be counted upon in addition to the presently established reserves. Assuming that this 4.4 trillion cubic feet is allocated to the later years of the thirty-year requirements of the Province, a reservation of

some 7.3 trillion cubic feet must be made from presently established reserves to ensure full and proper protection of Alberta requirements.

A further established reserve of some 13.7 trillion cubic feet (1,000 Btu basis) is required to meet present export commitments.

Total 7.3 13.7 / 21 Trillion cu ft

A detailed analysis of the manner of meeting the 1960 to 1989 requirements of Alberta and the present export commitments is presented in Appendix D. The analysis incorporates the "formula" method presented and discussed in previous reports. For the Medicine Hat-Redcliff area a detailed deliverability analysis is made.

V IN THE MATTER OF "CANADIAN PREFERENCE" AND THE CONTRACTABLE AND LONG TERM REQUIREMENTS OF CANADIAN MARKETS BEYOND ALBERTA

In its September, 1958, report the Board stated its policy with respect to the matter of "Canadian preference". While the Board's general thinking remains unchanged with respect to the preference which should be given to Canadian markets beyond Alberta and within the range of economic feasibility, nevertheless, the passing of the National Energy Board Act and the steps taken by the Federal Government thereunder, alleviate to a great extent the responsibility of Alberta authorities in this matter.

The Board has not heard full evidence on the contractable or the long term requirements of Canadian markets beyond Alberta and it assumes that such investigation of these matters as may be required will be made by the National Energy Board.

VI IN THE MATTER OF GAS SURPLUS TO THE 1960-1989 REQUIREMENTS OF ALBERTA AND THE PRESENT EXPORT COMMITMENTS

The Board estimates that of the established reserves of 27.7 trillion cubic feet of gas, and having regard to the 4.4 trillion cubic feet of gas which it is confident will be available by September 30, 1961, some 5.3 trillion cubic feet is surplus to the present and future requirements of Alberta and the present export commitments.

Details of the computation of this surplus and of the fields in which the surplus established reserves are located are presented in Appendix D.

VII IN THE MATTER OF THE DISPOSITION OF THE APPLICATION OF TRANS-CANADA PIPE LINES LIMITED

The Board finds that

(a) with respect to the application of Trans-Canada Pipe Lines Limited for an amendment to permit No. TC 54-1, that the additional quantities of gas requested are under contract to the applicant and are considered surplus to the present and future requirements of Alberta.

(b) with respect to the application of Trans-Canada Pipe Lines Limited for an amendment to permit No. TC 59-2, that the additional quantities of gas requested by the applicant are under contract to the applicant and are considered surplus to the present and future requirements of Alberta, and

(c) with respect to the application of Trans-Canada Pipe Lines Limited for a new permit, that the quantities of gas covered by the application are under contract to the applicant and are considered surplus to the present and future requirements of Alberta.

Accordingly the Board is prepared, with the approval of the Lieutenant Governor in Council, to issue the requested amendments to permits No. TC 54-1 and No. TC 59-2, subject to certain terms and conditions and in the form shown in Appendix E, and to issue the requested new permit to Trans-Canada Pipe Lines Limited in a form also shown in Appendix E.

VIII IN THE MATTER OF THE DISPOSITION OF THE APPLICATION OF ALBERTA AND SOUTHERN GAS CO. LTD.

The Board finds, with respect to the application of Alberta and Southern Gas Co. Ltd. for an amendment to permit No. AS 59-1, that the additional quantities of gas requested are largely under contract to the applicant and are considered surplus to the present and future requirements of Alberta. Accordingly, the Board is prepared, with the approval of the Lieutenant Governor in Council, to grant the permission to remove gas applied for by the amendment of permit No. AS 59-1 and the issue of a new permit, each in the form shown in Appendix F.

IX IN THE MATTER OF THE DISPOSITION OF THE APPLICATION OF SASKATCHEWAN POWER CORPORATION

The Board has considered the argument on behalf of the City of Medicine Hat. With respect to the argument that the Board should not hear the application to amend the permit granted following the hearing three years ago, the Board is satisfied that section 12 of The Gas Resources Preservation Act, 1956, gives it authority to do so, and that sufficient change in the situation was shown to provide ample justification for the hearing. The Board does not purport to decide on the argument concerning the power of the applicant to function outside Saskatchewan, but it notes that the applicant is registered, under another Alberta Act, to carry on business in the Province. If the Lieutenant Governor in Council, who it is anticipated may have the benefit of the views of his legal adviser, so approves, the Board will dispose of the application as hereinafter set out.

The Board finds that of the some 720 billion cubic feet of gas requested by Saskatchewan Power Corporation, in its application for an amendment to the permit granted it on August 20, 1957, some 617 billion cubic feet could be delivered at the rates requested by the applicant within a twenty-five-year period commencing January 1, 1960. This gas is under contract to Saskatchewan Power Corporation and is surplus to the present and future requirements of Alberta. Accordingly, the Board is prepared, with the approval of the Lieutenant Governor in Council, to issue an amendment to the permit,

subject to specific terms and conditions relating to the protection of the requirements of the Medicine Hat-Redcliff area, for the removal of some 617 billion cubic feet over a twenty-five-year period, the maximum period for which the Board is prepared to issue a permit. The form of the proposed amendment of permit is shown as Appendix G.

X IN THE MATTER OF THE DISPOSITION OF THE APPLICATION OF WESTCOAST TRANSMISSION COMPANY LIMITED

The Board finds, with respect to the application of Westcoast Transmission Company Limited for an amendment to permit No. WC 59-3 that the additional quantities of gas requested are about two-thirds under contract to the applicant, and are considered surplus to the present and future requirements of Alberta. Accordingly the Board is prepared, with the approval of the Lieutenant Governor in Council, to grant the proposed amendment of the permit in the form shown in Appendix H.

XI IN THE MATTER OF THE GAS WHICH WILL REMAIN SURPLUS TO THE 1960-1989 REQUIREMENTS OF ALBERTA AND ALL EXPORT COMMITMENTS ASSUMING THE GRANTING OF THE PRESENT APPLICATIONS

The Board estimates that if the present applications are granted some 3.6 trillion cubic feet of the present surplus of 5.3 trillion cubic feet would become committed,

leaving a remaining surplus in established reserves of 1.7 trillion cubic feet.

Respectfully submitted,

G. W. Govier, P. Eng.,
Deputy Chairman.

A. F. Manyluk, P. Eng.,
Board Member.

V. Millard,
Acting Board Member.

Dated at Calgary, Alberta,
this 31st day of December, 1959.

APPENDIX A

THE ESTABLISHED RESERVES OF GAS IN ALBERTA

In its last report issued in March, 1959, the Board estimated the established gas reserves of the Province as of December 31, 1958, to be 24.8 trillion cubic feet or the equivalent of 25.6 trillion cubic feet when converted to the basis of 1,000 Btu per cubic foot of gas. The Board now finds the established reserves of the Province to be 26.9 trillion cubic feet as of September 30, 1959, or the equivalent of 27.7 trillion cubic feet when converted to the basis of 1,000 Btu per cubic foot of gas. Of this 2.1 trillion cubic feet overall growth in reserves in this nine month period only 0.7 is attributed to new discoveries. Appreciation in previously discovered fields (due to development drilling) accounted for 1.4 trillion cubic feet, of which 1.1 trillion cubic was attributed to fields from which a permit for the export of gas had previously been granted.

During the hearing of the application of Trans-Canada Pipe Lines Limited in October some new evidence was submitted by Mr. Gordon A. Leslie and Mr. Edmond Foo of the company's staff respecting certain fields from which Trans-Canada has contracted for the purchase of gas.

Later in the month during the hearing of the application of Alberta and Southern Gas Co. Ltd., Mr. J. Milton Wege of Ralph E. Davis & Associates submitted estimates of gas reserves which he considered as a potential source of supply for the gas

export line proposed by Alberta and Southern. These included, in addition to those fields previously designated in the company's existing permit, his estimates for the following fields: Caroline, Fox Creek North, Fox Creek West, Kaybob, Lobstick and Brazeau River.

During the hearing of the application of Saskatchewan Power Corporation late in October natural gas reserve estimates were submitted on behalf of the applicant by Dr. J. R. Fanshawe and Mr. Howard Lowe, both of Northern Consultants. Dr. Fanshawe gave evidence with respect to the geology and Mr. Lowe the engineering aspects of the reserve estimates of the Medicine Hat and Etzikom Fields. During the same hearing The California Standard Company presented gas reserve estimates for the Bow Island sand and the Ellis sand of the Medicine Hat area by members of its staff, Mr. J. W. Coveney, geologist, and Mr. D. C. McLeod, engineer.

The application of Westcoast Transmission Company Limited was heard in November. At this hearing Dr. W. J. McPherson of McPherson-Hale Consultants Limited, on behalf of the applicant, reviewed the recent development in the Calgary Field and submitted a revised estimate of those reserves.

The Board staff has also reviewed all the new information which has become available since the Board's last estimate of gas reserves as of December 31, 1958. A revised estimate of gas reserves was prepared for certain fields where a change in the previous estimate was indicated and new estimates made of the reserves discovered since December 31, 1958. The Board's

findings respecting the reserves of certain fields is outlined in Table A-1. As in previous reports this table does not separately list fields having reserves of less than 10 billion cubic feet. Table A-1 presents:

Column

1. Name of field or area.

2. Geological formation or zone from which gas is obtained.

3. Estimated original gas in place expressed in billions of cubic feet at standard conditions.

4. Discount to be applied to original gas in place (column 3) to account for the gas left in the reservoir at abandonment.

5. Discount to be applied, after that for reservoir loss, to account for surface loss. This factor includes (where applicable) allowance for gas flared, operational loss, field and/or plant fuel, and processing shrinkage attending the removal of carbon dioxide, hydrogen sulphide, propane and butane plus.

6. Estimated disposable gas reserves as of September 30, 1959, expressed in billions of cubic feet at standard conditions.

7. Heating value of gas expressed in Btu per cubic foot (14.4 psia, 60°F) from actual analyses where available, otherwise estimated.

8. Equivalent value of column 6 expressed on the basis of gas at 1,000 Btu per cubic foot.

Comments with Regard to Certain Fields

BURNT TIMBER

This field was discovered in the central foothills of Alberta during September, 1959. The discovery well, Shell Burnt Timber No. 6-22-31-9, is located sixty miles north-west of Calgary. The Burnt Timber reserve exists in a porous

section of the Turner Valley formation of Mississippian age. Although only one well has penetrated the reservoir the Board after giving consideration to the type of structure has arbitrarily assigned 2,000 acres to this reserve.

CALGARY

In the Calgary Field the gas reserve estimates of the Elkton member of the Mississippian and the Crossfield formation of the Wabamun have been increased. The drilling of two additional wells warranted the westward extension of the Elkton reserve and the south-eastward extension of the Crossfield.

CARBON

The reserve estimate for the Carbon Field has been decreased as a result of additional drilling. One of the wells, located structurally high, proved to be oil-bearing instead of gas-bearing. Another well, located in a portion of the field previously considered proven, appears to have penetrated a tight segment of the reservoir. A third step-out well was successful but it did not fully compensate for the decrease caused by the other two wells.

CARSTAIRS

These reserves have been increased as a result of the drilling of two additional gas wells. The wells extended the proven reserve area to the north and east.

CESSFORD

During the development of the gas reserves of this field

for the Trans-Canada market a number of successful wells were completed beyond the limits of the area previously assigned by the Board to this reserve. By the extensions of the reserve area the Board has increased its estimate of gas reserves of the Viking formation by 55 Bcf, the Basal Colorado by 105 Bcf and the Basal Blairmore by 130 Bcf.

EAGLESHAM

The Eaglesham reserve has been increased. The previously published estimate was based on one Mississippian gas well. Since that time four wells located five miles east of the original well were drilled in close proximity to each other. Each of the four wells penetrated the eastern Mississippian gas reserve.

ETZIKOM

The Etzikom reserve estimate has been decreased since its publication in the September, 1958, report. The decrease is based on a consideration of both the volumetric and pressure decline methods of estimating reserves.

The volumetric method, used as a basis for the earlier estimate, has been revised. This revision was influenced by a well which was recently drilled within the proven confines of the Etzikom Field. This well appears to have encountered less reservoir thickness than would have been anticipated on the basis of the earlier study. Following an appraisal of this well, a more conservative method was adopted for estimating the reservoir thickness at the remaining wells in the field.

The pressure decline method, although based on an incomplete pressure history and subject to interpretation, also suggests that the reserves are considerably less than earlier estimated.

HUSSAR

The reserves contained within the Hussar Field by the Basal Colorado formation and the three productive units of the Blairmore formation have been increased.

The increase in the Basal Colorado reserve resulted from additional drilling that both broadened the previously known reserves in the north and central parts of the field and extended the reserve area south-westward over a distance in excess of ten miles. This extended portion of the reserve now appears to connect the Hussar and Duchess Fields.

The Blairmore reserve increase has been caused chiefly by additional drilling that resulted in a broadening of the Glauconitic Sandstone reserve areas in the northern and central parts of the field. The discovery of minor separated pools in the Glauconitic, Ostracod and Basal Quartz Sandstone units also contributed towards the reserve increase.

KAYBOB

The Notikewin and Cadomin non-associated gas reserves and the Beaverhill Lake solution gas reserves in the Kaybob Field have each been increased. The reserves in the two Cretaceous formations were discovered coincidental with the development of the oil reserves in the Beaverhill Lake formation. Additional

development drilling and further up-hole drill stem testing account for the reserve increase.

LOOKOUT BUTTE

This field was discovered in the southern foothills during July, 1959. The discovery well, B.A. Lookout Butte 11-31-1-28, is located five miles north of the international boundary and seven miles south of the Pincher Creek Field. No additional drilling has been undertaken to further evaluate this Mississippian reserve. The general potential of the area, the thickness of the gas-bearing interval and high flow rates tested at the well emphasize the significance of this discovery.

MEDICINE HAT

The current estimate of the total Medicine Hat reserves remaining after production coincides with the estimate presented in the March, 1959, report.

Additional drilling has warranted both a minor southward extension to the reserve area and an increase in the reservoir thickness over a part of the Saskatchewan Power Corporation export area. However, this increase has been compensated by a reduction in the previous estimate. The basis for the reduction was a local water contamination problem in the Saskatchewan Power Corporation export area and a re-appraisal, in the light of submitted evidence, of the net effective reservoir thicknesses at wells located in the area from which Trans-Canada has contracted for the purchase of gas.

PINCHER CREEK

The reserve estimate for this field is based on a map showing seismic information coordinated with well data. The revision of an earlier dated map was undertaken after acquiring additional seismic information and considering subsequent well data. This revision has resulted in a decrease in the previous estimate.

SWAN HILLS - SOLUTION GAS RESERVES

This oil field, located approximately 110 miles north-west of Edmonton, was discovered in March, 1957. Since that time it has undergone a development of the Beaverhill Lake oil reserves over an area of nearly fifty sections. This development has resulted in the establishment of a significant reserve of solution gas. It is expected that this reserve will increase as future drilling in the area is completed.

WATERTON

The Board has assigned no increase to the Mississippian gas reserves of this complicated foothills structure since its last estimate of December 31, 1958. Although seven new wells have been drilled, two of these in the northern part of the field were unsuccessful in the Mississippian but one encountered gas in the underlying Devonian, increasing the reserves of that formation.

In the southern part of the field three of the new wells encountered gas in the Mississippian and two were unsuccessful. Although the success ratio of wells in the field is rather low

it can be expected to improve with further development drilling.

WILDCAT HILLS

As this field was discovered in December, 1958, its reserve estimate appeared in the March, 1959, report. Since that time a successful follow-up well was drilled one and one-half miles north-west of the discovery well. Thus, the proven reserve area was extended north-westward and the reserve estimate increased accordingly.

TABLE A - 1

OIL AND GAS CONSERVATION BOARD

ESTABLISHED RESERVES OF NATURAL GAS IN THE PROVINCE OF ALBERTA, SEPTEMBER 30, 1959 (3)

(1) FIELD OR AREA	(2) ZONE	(3) ESTIMATED ORIGINAL GAS IN PLACE BCF	(4) RESERVOIR LOSS DISCOUNT PER CENT	(5) SURFACE LOSS DISCOUNT PER CENT	(6) DISPOSABLE GAS(3) BCF	(7) HEATING VALUE(4) BTU PER CU. FT.	(8) DISPOSABLE GAS(1000 BTU BASIS)(3) BCF	(9) REMARKS
ACHESON	VIKING	14.3(I) 14.0(II)	25	5	10	1010	10	(I) ORIGINAL (II) LESS 0.3 BCF PRODUCED TO JUNE 30, 1959.
	BASAL BLAIRMORE	37.4(I) 36.8(II)	20	15	25	1040	26	(I) ORIGINAL (II) LESS 0.6 BCF PRODUCED TO JUNE 30, 1959.
	LEDUC SOLUTION	86.4(I) 78.9(II)	45	25	30	1100	33	(I) ORIGINAL (II) LESS 7.5 BCF PRODUCED TO JUNE 30, 1959.
ALEXANDER	BASAL BLAIRMORE	89.9(I) 68.6(II)	20	5	48	1070	51	(I) ORIGINAL (II) LESS 21.3 BCF PRODUCED TO JUNE 30, 1959. INCLUDES CALAHOO.
ALHAMBRA	CARDIUM NON-ASSOCIATED	13.2	20	5	10	1000(E)	10	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
	CARDIUM SOLUTION	28.7(I) 27.7(II)	35	15	15	1150(E)	17	(I) ORIGINAL (II) LESS 1.0 BCF PRODUCED TO JUNE 30, 1959.
ALIX	BASAL BLAIRMORE	11.7	10	5	10	1070	11	
	NISKU	4.2	20	10	3	1110	3	
ANTELOPE	VIKING	10.5	20	5	8	1000	8	
	BANFF	5.0	15	5	4	1000	4	
ATHABASCA	LOWER CRETACEOUS	4.9(I) 3.9(II)	15	5	2.9	1010	2.9	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 1.0 BCF PRODUCED TO JUNE 30, 1959.
	WABAMUN	3.5	10	5	3	980(E)	3	WABAMUN PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
ATHABASCA WEST	WABAMUN	1.7(I) 1.3(II)	10	5	1.1	980	1.1	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 0.4 BCF PRODUCED TO JUNE 30, 1959.

TABLE A - 1 (CONT)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FIELD OR AREA	ZONE	ESTIMATED ORIGINAL GAS IN PLACE BCF	RESERVOIR LOSS DISCOUNT PER CENT	SURFACE LOSS DISCOUNT PER CENT	DISPOSABLE GAS[3] BCF	HEATING VALUE[4] BTU PER CU. FT.	DISPOSABLE GAS (1000 BTU BASIS)[3] BCF	REMARKS
ATLEE-BUFFALO	VIKING	98.9(I) 98.5(II)	25	5	70	940	66	(I) ORIGINAL (II) LESS 0.4 BCF PRODUCED TO JUNE 30, 1959.
	BASAL BLAIRMORE	73.0(I) 72.6(II)	20	5	55	960	53	(I) ORIGINAL (II) LESS 0.4 BCF PRODUCED TO JUNE 30, 1959.
BEAVER CREEK	WABAMUN	182.0	10	45	90	970	87	
BEAVERHILL LAKE	VIKING	172.0(I) 171.6(II)	20	5	130	980	127	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 0.4 BCF PRODUCED TO JUNE 30, 1959.
	BASAL BLAIRMORE	3.7	15	5	3	970(E)	3	
BELLOY	CADOTTE	5.3	20	5	4	1000(E)	4	
	NOTIKEWIN	9.2	20	5	7	980	7	
	GETHING	61.9	15	5	50	980	49	
	MISSISSIPPIAN	17.5	10	5	15	1100	16	
BELLSHILL LAKE	VIKING	5.6	25	5	4	1020	4	
	BLAIRMORE NON-ASSOCIATED	37.2	15	5	30	970	29	
	BLAIRMORE ASSOCIATED	2.8	15	15	2	970	2	BLAIRMORE ASSOCIATED AND SOLUTION RESERVES PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
	BLAIRMORE SOLUTION	40.4(I) 39.8(II)	40	15	20	990(E)	20	(I) ORIGINAL (II) LESS 0.6 BCF PRODUCED TO JUNE 30, 1959.
BERLAND RIVER	LEDUC	445	10	25	300	980	294	
BERLAND RIVER WEST	WABAMUN	23.8	10	30	15	1000	15	
BIG LAKE	BLAIRMORE	37.2	15	5	30	1070	32	
BINDLOSS	VIKING	344.0(I) 335.8(II)	15	5	270	930	251	(I) ORIGINAL (II) LESS 8.2 BCF PRODUCED TO JUNE 30, 1959.
	BASAL BLAIRMORE	43.4	15	5	35	970	34	
BITTERN LAKE	VIKING	1.4	25	5	1	1000(E)	1	
	BLAIRMORE	29.3	10	5	25	1050(E)	26	

TABLE A - 1 (CONT)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FIELD OR AREA	ZONE	ESTIMATED ORIGINAL GAS IN PLACE BCF	RESERVOIR LOSS DISCOUNT PER CENT	SURFACE LOSS DISCOUNT PER CENT	DISPOSABLE GAS[3] BCF	HEATING VALUE[4] BTU PER CU. FT.	DISPOSABLE GAS (1000 BTU BASIS)[3] BCF	REMARKS
BLACK BUTTE	BOW ISLAND	14.1	10	5	12	990	12	
	JURASSIC	22.9(I) 10.9(II)	20	5	6	980	6	(I) ORIGINAL (II) LESS 12.0 BCF PRODUCED TO JUNE 30, 1959.
	RUNDLE	17.7	15	20	12	1000(E)	12	
BLUERIDGE	DETRITAL	14.0	10	5	12	1080	13	
	MISSISSIPPIAN	1.3	20	5	1	1110	1	
BONNIE GLEN	LEDUC ASSOCIATED	430.1(I) 430.6(II)	10	15	330	1200	396	(I) ORIGINAL (II) PLUS 0.5 BCF INJECTED TO JUNE 30, 1959.
	LEDUC SOLUTION	548.0(I) 513.5(II)	40	25	220	1200	264	(I) ORIGINAL (II) LESS 35.5 BCF PRODUCED TO JUNE 30, 1959.
BONNYVILLE	COLONY ASSOCIATED	4.7(I) 3.7(II)	15	5	2.8	960	2.7	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 1.0 BCF PRODUCED TO JUNE 30, 1959.
BOW ISLAND	BOW ISLAND	22.4	20	5	17	1090	19	CWNG STORAGE RESERVOIR.
BOYLE-MUSTANG-AMISK LAKE	BLAIRMORE	7.0	25	5	5	980(E)	5	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
	NISKU	6.2	15	5	5	970	5	
BRAEBURN	CADOMIN	11.7	10	5	10	1040	10	
	TRIASSIC	7.9	20	5	6	1070	6	
	PERMO-PENN	81.9	10	5	70	1010	71	
BRAZEAU RIVER	MISSISSIPPIAN	27.8	10	20	20	1020(E)	20	
BROOKS-NORTH EAST	BOW ISLAND	13.2	20	5	10	940(E)	9	POSSIBLE LOCAL SUPPLY.
	BASAL BLAIRMORE	12.2(I) 10.7(II)	10	5	9	1010	9	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 1.5 BCF PRODUCED TO JUNE 30, 1959.
BROOKS-TILLEY	MILK RIVER	37.1(I) 33.7(II)	20	5	25	970	24	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 3.4 BCF PRODUCED TO JUNE 30, 1959.
	BASAL BLAIRMORE	3.9	20	5	3	1140	3	

TABLE A - 1 (CONT)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FIELD OR AREA	ZONE	ESTIMATED ORIGINAL GAS IN PLACE BCF	RESERVOIR LOSS DISCOUNT PER CENT	SURFACE LOSS DISCOUNT PER CENT	DISPOSABLE GAS(3) BCF	HEATING VALUE(4) BTU PER CU. FT.	DISPOSABLE GAS (1000 BTU BASIS)(3) BCF	REMARKS
BURNT RIVER	PADDY	2.3	10	5	2	990	2	
	BLUESKY	9.4	10	5	8	1000(E)	8	
BURNT TIMBER	MISSISSIPPIAN	157	10	15	120	1060(E)	127	
CALGARY	BASAL BLAIRMORE	13.2	20	5	10	1000(E)	10	
	MISSISSIPPIAN	680	10	15	520	1050	546	
	WABAMUN	1382	15	51(I)	600	960	576	(I) HIGH LOSS DUE TO VERY HIGH ACID GAS CONTENT.
CAMPBELL-NAMAO	BASAL BLAIRMORE ASSOCIATED	36.8(I) 37.4(II)	10	5	32	1000(E)	32	(I) ORIGINAL (II) PLUS 0.6 BCF INJECTED TO JUNE 30, 1959.
	BASAL BLAIRMORE SOLUTION	14.0(I) 11.5(II)	40	15	5	990	5	(I) ORIGINAL (II) LESS 2.5 BCF PRODUCED TO JUNE 30, 1959.
CARBON	VIKING	3.9	20	5	3	1000(E)	3	
	BLAIRMORE	136	15	5	110	1120	123	(I) ORIGINAL (II) LESS 0.2 BCF PRODUCED TO JUNE 30, 1959.
CAROLINE	BASAL BLAIRMORE	18.5	10	10	15	1050(E)	16	
CARSON CREEK	BEAVERHILL LAKE	46.8	10	5	40	1000(E)	40	
CARSON CREEK NORTH	BEAVERHILL LAKE ASSOCIATED	51.9	10	25	35	1040	36	
	BEAVERHILL LAKE SOLUTION	11.8	35	35	5	1140	6	
CARSTAIRS	BASAL BLAIRMORE	14.8	10	10	12	1080	13	
	MISSISSIPPIAN	980	10	15	750	1050(E)	787	
CASTOR	VIKING	22.3	15	5	18	1020	18	
	BLAIRMORE	2.3	10	5	2	1050(E)	2	
CESSFORD	VIKING	161	15	5	130	1030	134	
	BASAL COLORADO	1180(I) 1161.3(II)	20	5	880	1030	907	(I) ORIGINAL (II) LESS 18.7 BCF PRODUCED TO JUNE 30, 1959.
	BASAL BLAIRMORE	434	15	5	350	1030	361	
CHIGWELL	BASAL BLAIRMORE	74.1	10	10	60	1000(E)	60	

TABLE A - 1 (CONT)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FIELD OR AREA	ZONE	ESTIMATED ORIGINAL GAS IN PLACE BCF	RESERVOIR LOSS DISCOUNT PER CENT	SURFACE LOSS DISCOUNT PER CENT	DISPOSABLE GAS[3] BCF	HEATING VALUE[4] BTU PER CU. FT.	DISPOSABLE GAS (1000 BTU BASIS)[3] BCF	REMARKS
CHINOOK RIDGE	PADDY	6.9	20	10	5	1000(E)	5	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
	CADOTTE	24.7	10	10	20	1000(E)	20	
	NOTIKEWIN	24.7	10	10	20	1000(E)	20	
CHISHOLM	BLAIRMORE	11.7	10	5	10	1000(E)	10	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
CLEAR HILLS	TRIASSIC	8.2	10	5	7	1070(E)	7	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
	PERMO-PENN	1.4	25	5	1	1010(E)	1	
	LEDUC	3.7	15	5	3	1050(E)	3	
CLIVE	VIKING	3.9	20	5	3	970(E)	3	
	BASAL BLAIRMORE	3.7	15	5	3	1000(E)	3	
	NISKU ASSOCIATED	9.2	10	15	7	1130	8	
	LEDUC ASSOCIATED	4.7	15	25	3	1190	4	
COLD LAKE	COLONY	5.1(I) 3.4(II)	25	5	2.0	980	2	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 1.7 BCF PRODUCED TO JUNE 30, 1959.
COMREY	BOW ISLAND	55.7(I) 53.0(II)	10	5	45	920	41	(I) ORIGINAL (II) LESS 2.7 BCF PRODUCED TO JUNE 30, 1959.
CONNORSVILLE	VIKING	8.7	15	5	7	970	7	
	BASAL BLAIRMORE	13.6	15	5	11	1110	12	
CONTROL	VIKING	12.4	15	5	10	950(E)	10	
	BASAL BLAIRMORE	11.7	10	5	10	1010(E)	10	
COUNTESS	VIKING	65.8	20	5	50	950	48	
	BASAL BLAIRMORE	5.0	15	5	4	1010(E)	4	
CROSSFIELD	MISSISSIPPIAN	392	10	15	300	1050	315	
DIXONVILLE	GETHING	35.6	20	5	27	980	26	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
DONALDA	VIKING	14.9	15	5	12	950	11	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
	DETRITAL	2.5	15	5	2	970(E)	2	

TABLE A - 1(CONT)

(1) FIELD OR AREA	(2) ZONE	(3) ESTIMATED ORIGINAL GAS IN PLACE BCF	(4) RESERVOIR LOSS DISCOUNT PER CENT	(5) SURFACE LOSS DISCOUNT PER CENT	(6) DISPOSABLE GAS[3] BCF	(7) HEATING VALUE[4] BTU PER CU. FT.	(8) DISPOSABLE GAS (1000 BTU BASIS)[3] BCF	(9) REMARKS
DOWLING LAKE	DETRITAL	0.8(I) 0.3(II)	20	5	0.1	1130	0.1	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 0.5 BCF PRODUCED TO JUNE 30, 1959.
DUCHESS	VIKING	13.2	20	5	10	990	10	
	BASAL COLORADO	11.8	20	5	9	1010(E)	9	
DUHAMEL	VIKING	3.8(I) 3.6(II)	10	5	3	980(E)	3	(I) ORIGINAL (II) LESS 0.2 BCF PRODUCED TO JUNE 30, 1959.
	BLAIRMORE	2.3	10	5	2	1000(E)	2	VIKING AND DEVONIAN GAS IS BEING INJECTED INTO LEDUC.
	DEVONIAN	12.6(I) 11.5(II)	35	15	6	1250	8	(I) ORIGINAL (II) LESS 1.4 BCF PRODUCED TO JUNE 30, 1959. INJECTED 0.3 BCF TO JUNE 30, 1959. NET PRODUCTION 1.1 BCF. DEVONIAN PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
DUVERNAY	VIKING	1.7(I) 0.5(II)	20	5	0.1	960	0.1	SUPPLIES CHEMICAL PLANT. (I) ORIGINAL (II) LESS 1.2 BCF PRODUCED TO JUNE 30, 1959.
DYBERG	BASAL BELLY RIVER	3.5	10	5	3	930	3	
	VIKING	9.4	10	5	8	980(E)	8	
	BASAL BLAIRMORE	3.7	15	5	3	1000(E)	3	
EAGLESHAM	GETHING	5.0	15	5	4	980(E)	4	
	CADOMIN	4.7	10	5	4	1040(E)	4	
	MISSISSIPPIAN	105	10	5	90	1090	98	
ELK POINT	BLAIRMORE	4.3(I) 3.8(II)	25	5	2.7	970	2.6	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 0.5 BCF PRODUCED TO JUNE 30, 1959.
ENCHANT	BOW ISLAND	21.0	25	5	15	950(E)	14	
	BASAL BLAIRMORE	11.1	20	10	8	980(E)	8	
	ELLIS	2.8	25	5	2	970(E)	2	
	MISSISSIPPIAN	5.6	20	10	4	1020	4	

TABLE A-1 (CONT)

(1) FIELD OR AREA	(2) ZONE	(3) ESTIMATED ORIGINAL GAS IN PLACE BCF	(4) RESERVOIR LOSS DISCOUNT PER CENT	(5) SURFACE LOSS DISCOUNT PER CENT	(6) DISPOSABLE GAS[3] BCF	(7) HEATING VALUE[4] BTU PER CU. FT.	(8) DISPOSABLE GAS (1000 BTU BASIS)[3] BCF	(9) REMARKS
ERSKINE	VIKING	4.2	25	5	3	1020	3	
	BLAIRMORE	20.0(I) 19.6(II)	15	10	15	1070	16	(I) ORIGINAL (II) LESS 0.4 BCF PRODUCED TO JUNE 30, 1959.
	LEDUC ASSOCIATED	30.6	10	20	22	1050(E)	22	
	LEDUC SOLUTION	15.9(I) 13.1(II)	35	20	6	1090	7	(I) ORIGINAL (II) LESS 2.8 BCF PRODUCED TO JUNE 30, 1959. LEDUC SOLUTION PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
ETZIKOM	BOW ISLAND	92.6(I) 83.4(II)	15	5	65	910	59	(I) ORIGINAL (II) LESS 9.2 BCF PRODUCED TO JUNE 30, 1959.
	BASAL BLAIRMORE	1.4	25	5	1	990	1	
EXCELSIOR	VIKING	8.7	15	5	7	980(E)	7	
	BASAL BLAIRMORE ASSOCIATED	38.6	10	5	33	950	31	
FAIRYDELL-BON ACCORD	VIKING	126.7(I) 120.2(II)	20	5	90	1000	90	(I) ORIGINAL (II) LESS 6.5 BCF PRODUCED TO JUNE 30, 1959.
	BASAL BLAIRMORE	19.7	20	5	15	980	15	
FAUST SOUTH	GETHING	11.7	10	5	10	970	10	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
FENN-BIG VALLEY	VIKING	21.8(I) 21.1(II)	15	5	17	980(E)	17	(I) ORIGINAL (II) LESS 0.6 BCF PRODUCED TO JUNE 30, 1959.
	NISKU SOLUTION	217.3(I) 201.5(II)	45	45	57	1090	62	(I) ORIGINAL (II) LESS 15.8 BCF PRODUCED TO JUNE 30, 1959.
	LEDUC ASSOCIATED AND SOLUTION	10.8(I) 9.8(II)	40	45	3	1090	3	(I) ORIGINAL (II) LESS 1.0 BCF PRODUCED TO JUNE 30, 1959.
FIGURE LAKE	VIKING	2.5	15	5	2	940	2	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
	BLAIRMORE	11.8	20	5	9	980(E)	9	
	NISKU	26.3	20	5	20	970(E)	19	
FOREMOST	BOW ISLAND	31.0(I) 25.2(II)	10	5	21	930	20	(I) ORIGINAL (II) LESS 5.8 BCF PRODUCED TO JUNE 30, 1959.

TABLE A - 1 (CONT)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FIELD OR AREA	ZONE	ESTIMATED ORIGINAL GAS IN PLACE BCF	RESERVOIR LOSS DISCOUNT PER CENT	SURFACE LOSS DISCOUNT PER CENT	DISPOSABLE GAS[3] BCF	HEATING VALUE[4] BTU PER CU. FT.	DISPOSABLE GAS (1000 BTU BASIS)[3] BCF	REMARKS
FORT SASKATCHEWAN	VIKING	170.4(I) 143.4(II)	10	5	120	980	118	(I) ORIGINAL (II) LESS 27.0 BCF PRODUCED TO JUNE 30, 1959.
FOX CREEK WEST	GETHING	4.7	10	5	4	1000(E)	4	
	NISKU	18.1	10	20	13	1220	16	
GARRINGTON	VIKING	18.5	10	10	15	980(E)	15	
	LEDUC	30.9	10	10	25	1000(E)	25	
	CARDIUM SOLUTION	20.6(I) 20.5(II)	35	25	10	1040	10	(I) ORIGINAL (II) LESS 0.1 BCF PRODUCED TO JUNE 30, 1959. CARDIUM SOLUTION RESERVES PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
GHOST PINE	BLAIRMORE	15.7	15	10	12	990(E)	12	
	MISSISSIPPIAN	2.6	15	10	2	1050(E)	2	
GILBY	VIKING NON-ASSOCIATED	4.2	20	10	3	1200	4	
	BASAL BLAIRMORE	65.5(I) 65.3(II)	10	15	50	1140	57	(I) ORIGINAL (II) LESS 0.2 BCF PRODUCED TO JUNE 30, 1959.
	DETRITAL ASSOCIATED	98.0	10	15	75	1000(E)	75	
	DETRITAL SOLUTION	10.4	40	20	5	1000(E)	5	
	MISSISSIPPIAN	248	10	15	190	1060	201	
	WABAMUN	6.9	10	20	5	1150	6	
GLEN PARK	BLAIRMORE	9.4(I) 8.8(II)	15	5	7	1120	8	(I) ORIGINAL (II) LESS 0.6 BCF PRODUCED TO JUNE 30, 1959.
	LEDUC SOLUTION	18.0(I) 16.6(II)	40	15	8	1230	10	(I) ORIGINAL (II) LESS 1.4 BCF PRODUCED TO JUNE 30, 1959.
GOLDEN SPIKE	VIKING	4.5(I) 3.0(II)	20	5	2	1030	2	(I) ORIGINAL (II) LESS 1.5 BCF PRODUCED TO JUNE 30, 1959.
	BASAL BLAIRMORE	23.4(I) 22.5(II)	15	5	18	1030	19	(I) ORIGINAL (II) LESS 0.9 BCF PRODUCED TO JUNE 30, 1959.
	WABAMUN	17.1(I) 13.9(II)	10	10	11	1040	11	(I) ORIGINAL (II) LESS 3.2 BCF PRODUCED TO JUNE 30, 1959.

TABLE A-1 (CONT)

(1) FIELD OR AREA	(2) ZONE	(3) ESTIMATED ORIGINAL GAS IN PLACE BCF	(4) RESERVOIR LOSS DISCOUNT PER CENT	(5) SURFACE LOSS DISCOUNT PER CENT	(6) DISPOSABLE GAS(3) BCF	(7) HEATING VALUE(4) BTU PER CU. FT.	(8) DISPOSABLE GAS (1000 BTU BASIS)(3) BCF	(9) REMARKS
GOLDEN SPIKE (CONT)	NISKU ASSOCIATED	3.9	10	15	3	1200	4	
	NISKU SOLUTION	4.9(I) 4.2(II)	35	20	2	1200	2	(I) ORIGINAL (II) LESS 0.7 BCF PRODUCED TO JUNE 30, 1959.
	LEDUC SOLUTION	98.3(I) 104.6(II)	25	25	60	1270	76	(I) ORIGINAL (II) LESS 7.4 BCF PRODUCED TO JUNE 30, 1959. INJECTED 13.7 BCF TO JUNE 30, 1959. NET INJECTION 6.3 BCF.
GOODWIN LAKE	VIKING	3.9	20	5	3	1000(E)	3	
	NORDEGG	30.9	10	10	25	1050	26	
GORDONDALE	CADOTTE	87.2(I) 82.4(II)	10	5	70	980(E)	69	(I) ORIGINAL (II) LESS 4.8 BCF PRODUCED TO JUNE 30, 1959.
	NOTIKEWIN	4.1(I) 4.0(II)	20	5	3	1000(E)	3	(I) ORIGINAL (II) LESS 0.1 BCF PRODUCED TO JUNE 30, 1959.
	GETHING	87.0(I) 77.0(II)	10	5	65	1030	67	(I) ORIGINAL (II) LESS 10.0 BCF PRODUCED TO JUNE 30, 1959.
GRASSY ISLAND LAKE	VIKING	28.1	25	5	20	980(E)	20	
	BANFF	3.5	10	5	3	1000(E)	3	
HACKETT	BLAIRMORE	37.0	10	10	30	1080	32	
HAIRY HILL	VIKING	2.8	25	5	2	960	2	
	BLAIRMORE	18.4(I) 15.3(II)	20	5	11	980	11	SUPPLIES CHEMICAL PLANT. (I) ORIGINAL (II) LESS 3.1 BCF PRODUCED TO JUNE 30, 1959.
HAMELIN CREEK	CADOTTE	7.0	25	5	5	980(E)	5	
	GETHING	3.7	15	5	3	990	3	
	CADOMIN	41.8(I) 41.0(II)	10	5	35	1040(E)	36	(I) ORIGINAL (II) LESS 0.8 BCF PRODUCED TO JUNE 30, 1959.
HAMILTON LAKE	VIKING	57.2(I) 56.4(II)	25	5	40	1020	41	(I) ORIGINAL (II) LESS 0.8 BCF PRODUCED TO JUNE 30, 1959.

TABLE A - 1 (CONT)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FIELD OR AREA	ZONE	ESTIMATED ORIGINAL GAS IN PLACE BCF	RESERVOIR LOSS DISCOUNT PER CENT	SURFACE LOSS DISCOUNT PER CENT	DISPOSABLE GAS[3] BCF	HEATING VALUE[4] BTU PER CU. FT.	DISPOSABLE GAS (1000 BTU BASIS)[3] BCF	REMARKS
HARMATTAN EAST	MISSISSIPPIAN NON-ASSOCIATED	45.8	10	15	35	1060	37	
	MISSISSIPPIAN ASSOCIATED	262	10	15	200	1060	212	
	MISSISSIPPIAN SOLUTION	94.0(I) 92.9(II)	35	25	45	1060(E)	48	(I) ORIGINAL (II) LESS 1.1 BCF PRODUCED TO JUNE 30, 1959.
HARMATTAN-ELKTON	MISSISSIPPIAN NON-ASSOCIATED	48.6	10	20	35	1020(E)	36	
	MISSISSIPPIAN ASSOCIATED	1250	10	20	900	1060	954	
	MISSISSIPPIAN SOLUTION	216.6(I) 208.1(II)	35	25	100	1260	126	(I) ORIGINAL (II) LESS 8.5 BCF PRODUCED TO JUNE 30, 1959.
HERCULES	VIKING	11.1	15	5	9	1030	9	
	BASAL BLAIRMORE	12.4	15	5	10	940	9	
HOLBORNE	CARDIUM	8.4	25	5	6	960	6	
	BASAL BLAIRMORE	25.0	20	10	18	1100(E)	20	
HOMEGLEN-RIMBEY	LEDUC ASSOCIATED	953.0(I) 945.1(II)	10	20	680	1060	721	(I) ORIGINAL (II) LESS 7.9 BCF PRODUCED TO JUNE 30, 1959.
	LEDUC SOLUTION	77.5(I) 75.0(II)	40	25	33	1060	35	(I) ORIGINAL (II) LESS 2.5 BCF PRODUCED TO JUNE 30, 1959.
HUSSAR	VIKING	32.8	20	5	25	980(E)	25	
	BASAL COLORADO	210	25	5	150	1010	151	
	BLAIRMORE	351	10	5	300	1090	327	
INNISFAIL	MISSISSIPPIAN	11.7	10	5	10	1060(E)	11	
	WABAMUN	3.9	15	10	3	1150(E)	3	
	LEDUC ASSOCIATED	17.1	10	35	10	1000(E)	10	
	LEDUC SOLUTION	198.1(I) 194.4(II)	40	35	75	1060	80	(I) ORIGINAL (II) LESS 3.7 BCF PRODUCED TO JUNE 30, 1959.
JENNER	BASAL BLAIRMORE	14.9	15	5	12	1030(E)	12	

TABLE A - 1 (CONT)

(1) FIELD OR AREA	(2) ZONE	(3) ESTIMATED ORIGINAL GAS IN PLACE BCF	(4) RESERVOIR LOSS DISCOUNT PER CENT	(5) SURFACE LOSS DISCOUNT PER CENT	(6) DISPOSABLE GAS[3] BCF	(7) HEATING VALUE[4] BTU PER CU. FT.	(8) DISPOSABLE GAS (1000 BTU BASIS)[3] BCF	(9) REMARKS
JOARCAM	VIKING ASSOCIATED	65.8	20	5	50	1020	51	
	VIKING SOLUTION	53.4(I) 36.7(II)	40	15	13	1070	14	(I) ORIGINAL (II) LESS 16.7 BCF PRODUCED TO JUNE 30, 1959. PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
JOFFRE	VIKING SOLUTION	34.4(I) 24.4(II)	40	15	9	1170	11	(I) ORIGINAL (II) LESS 10.0 BCF PRODUCED TO JUNE 30, 1959. PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
	BASAL BLAIRMORE	20.8	20	10	15	1000(E)	15	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
	NISKU SOLUTION	107.2(I) 105.3(II)	40	20	50	1240	62	(I) ORIGINAL (II) LESS 1.9 BCF PRODUCED TO JUNE 30, 1959.
JUDY CREEK	VIKING	5.3	20	5	4	1000(E)	4	
	BEAVERHILL LAKE SOLUTION	71.5	40	30	30	1100(E)	33	
JUMPING POUND	MISSISSIPPIAN	781(I) 657(II)	10	17	480	1030	495	(I) ORIGINAL (II) LESS 128.6 BCF PRODUCED TO JUNE 30, 1959. INJECTED 4.8 BCF TO JUNE 30TH, 1959. NET PRODUCTION 123.8 BCF.
KAYBOB	NOTIKEWIN	65.8	20	5	50	1000	50	
	CADOMIN	81.9	10	5	70	1020	41	
	WINTERBURN	3.7	10	10	3	1050(E)	3	
	BEAVERHILL LAKE SOLUTION	214.3(I) 213.4(II)	35	35	90	1120	106	(I) ORIGINAL (II) LESS 0.9 BCF PRODUCED TO JUNE 30, 1959.
KESSLER	VIKING	56.1	25	5	40	970	39	
KEVISVILLE	LEDUC	18.5	10	40	10	960	10	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
KEYSTONE	BASAL BELLY RIVER	58.5	10	5	50	1000	50	
	CARDIUM SOLUTION	73.5(I) 72.4(II)	35	25	35	1140	40	(I) ORIGINAL (II) LESS 1.1 BCF PRODUCED TO JUNE 30, 1959.
	BLAIRMORE	3.9	20	5	3	980(E)	3	
	NORDEGG	5.8	10	5	5	1050(E)	5	

TABLE A-1 (CONT)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FIELD OR AREA	ZONE	ESTIMATED ORIGINAL GAS IN PLACE BCF	RESERVOIR LOSS DISCOUNT PER CENT	SURFACE LOSS DISCOUNT PER CENT	DISPOSABLE GAS(3) BCF	HEATING VALUE(4) BTU PER CU. FT.	DISPOSABLE GAS (1000 BTU BASIS)(3) BCF	REMARKS
LAC LA BICHE	VIKING	46.0	20	5	35	990	35	SUPPLIES LOCAL UTILITY.
	BLAIRMORE	11.8	20	5	9	990	9	
LEAFLAND	CARDIUM SOLUTION	22.9(I) 22.7(II)	35	25	11	1150(E)	13	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH. (I) ORIGINAL (II) LESS 0.2 BCF PRODUCED TO JUNE 30, 1959.
	BASAL BLAIRMORE	5.3	20	5	4	1000(E)	4	
	MISSISSIPPIAN	2.6	20	5	2	1100(E)	2	
LEAHURST	BASAL BLAIRMORE	8.8(I) 8.2(II)	15	5	6.6	1080	7.1	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 0.6 BCF PRODUCED TO JUNE 30, 1959.
LEDUC-WOODBEND	VIKING	19.7(I) 19.1(II)	20	5	15	1050	16	(I) ORIGINAL (II) LESS 0.6 BCF PRODUCED TO JUNE 30, 1959.
	BLAIRMORE	129.6(I) 126.9(II)	25	10	85	1160	99	(I) ORIGINAL (II) LESS 2.7 BCF PRODUCED TO JUNE 30, 1959. 14.0 BCF CONSIDERED BEYOND ECONOMIC REACH.
	NISKU ASSOCIATED	36.6	10	15	28	1160	32	
	NISKU SOLUTION	135.1(I) 91.0(II)	25	30	40	1160	46	(I) ORIGINAL (II) LESS 44.1 BCF PRODUCED TO JUNE 30, 1959.
	LEDUC ASSOCIATED	449.0(I) 420.8(II)	15	15	300	1160	348	(I) ORIGINAL (II) LESS 29.0 BCF PRODUCED TO JUNE 30, 1959. INJECTED 0.8 BCF TO JUNE 30TH, 1959. NET PRODUCED 28.2 BCF.
	LEDUC SOLUTION	195.9(I) 128.5(II)	40	30	35	1160	41	(I) ORIGINAL (II) LESS 67.4 BCF PRODUCED TO JUNE 30, 1959.
LINDBERGH	VIKING	3.2	35	5	2	970	2	
	BLAIRMORE	12.7(I) 10.0(II)	15	5	7.7	980(E)	7.6	SUPPLIES SALT PLANT. (I) ORIGINAL (II) LESS 2.7 BCF PRODUCED TO JUNE 30, 1959.
LLOYDMINSTER	COLONY	18.8	40	15	2.9	920	2.7	SUPPLIES LOCAL UTILITY.
	SPARKY	21.0	60	40	1.5	930	1.4	14.0 BCF PRODUCED FROM BOTH ZONES TO JUNE 30, 1959.

TABLE A-1 (CONT)

(1) FIELD OR AREA	(2) ZONE	(3) ESTIMATED ORIGINAL GAS IN PLACE BCF	(4) RESERVOIR LOSS DISCOUNT PER CENT	(5) SURFACE LOSS DISCOUNT PER CENT	(6) DISPOSABLE GAS[3] BCF	(7) HEATING VALUE[4] BTU PER CU. FT.	(8) DISPOSABLE GAS (1000 BTU BASIS)[3] BCF	(9) REMARKS
LOBSTICK	BLAIRMORE	58.5	10	5	50	1100(E)	55	FORMERLY CALLED ROUND VALLEY.
LONE PINE CREEK	BASAL BLAIRMORE	3.7	10	10	3	1000(E)	3	
	WABAMUN	156	20	20	100	1010	101	
LOOKOUT BUTTE	MISSISSIPPIAN	125	10	20	90	1020(E)	92	
LOVETT	BLAIRMORE	11.7	10	5	10	1020(E)	10	
	MISSISSIPPIAN	86.4	10	10	70	1020	71	
MAJEAU LAKE	BLAIRMORE	2.6	20	5	2	980(E)	2	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
	MISSISSIPPIAN	11.7	10	5	10	1050(E)	11	
MALMO	VIKING	3.7	15	5	3	980(E)	3	
	BASAL BLAIRMORE	9.1(I) 8.6(II)	30	15	5	1100	6	(I) ORIGINAL (II) LESS 0.5 BCF PRODUCED TO JUNE 30, 1959.
	DEVONIAN ASSOCIATED AND SOLUTION	19.3(I) 17.0(II)	30	20	9	1100	10	(I) ORIGINAL (II) LESS 2.3 BCF PRODUCED TO JUNE 30, 1959. DEVONIAN PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
MANYBERRIES	BOW ISLAND	73.0(I) 64.1(II)	20	5	47	920	43	(I) ORIGINAL (II) LESS 8.9 BCF PRODUCED TO JUNE 30, 1959.
MAZEPPA	MISSISSIPPIAN	19.6	10	15	15	1040	16	
MEDICINE HAT	MEDICINE HAT	2397(I) 2180.3(II)	25	5	1500	950	1423	(I) ORIGINAL (II) LESS 216.7 BCF PRODUCED TO JUNE 30, 1959.
	BOW ISLAND	19.7	20	5	15	950(E)	14	
	ELLIS	24.8	15	5	20	980(E)	20	
MEDICINE RIVER	BASAL BLAIRMORE	6.2	10	10	5	1020(E)	5	
	DETRITAL	7.4	10	10	6	1050(E)	6	
MILLET	BLAIRMORE	20.8	20	10	15	1000(E)	15	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
MINNEHIK-BUCK LAKE	BASAL BLAIRMORE	5.6	25	5	4	980(E)	4	
	MISSISSIPPIAN	262	10	15	200	1070	214	

TABLE A - 1 (CONT)

(1) FIELD OR AREA	(2) ZONE	(3) ESTIMATED ORIGINAL GAS IN PLACE BCF	(4) RESERVOIR LOSS DISCOUNT PER CENT	(5) SURFACE LOSS DISCOUNT PER CENT	(6) DISPOSABLE GAS[3] BCF	(7) HEATING VALUE[4] BTU PER CU. FT.	(8) DISPOSABLE GAS (1000 BTU BASIS)[3] BCF	(9) REMARKS
MORINVILLE	VIKING	2.8	25	5	2	980(E)	2	
	BASAL BLAIRMORE	139.3(I) 115.7(II)	15	5	90	1075	97	(I) ORIGINAL (II) LESS 23.6 BCF PRODUCED TO JUNE 30, 1959.
MOUNTAIN PARK	TRIASSIC	29.2	10	5	25	1070(E)	27	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
NEVIS	BLAIRMORE	65.4	15	10	50	1170	59	
	DEVONIAN	735	10	20	530	950	504	
NEW NORWAY	VIKING	2.6	20	5	2	980(E)	2	
	BASAL BLAIRMORE	5.8	10	5	5	980(E)	5	
	DEVONIAN ASSOCIATED AND SOLUTION	5.8(I) 4.7(II)	35	25	2	1350	3	(I) ORIGINAL (II) LESS 1.1 BCF PRODUCED TO JUNE 30, 1959.
NORMANDVILLE	BLUESKY	13.2	20	5	10	960	10	
	TRIASSIC	3.7	15	5	3	1070(E)	3	
	MISSISSIPPIAN	23.4	10	5	20	1030	21	
OBED	MISSISSIPPIAN	12.3	10	10	10	1020(E)	10	
OBERLIN	VIKING	0.6	25	5	0.4	980(E)	0.4	
	BASAL BLAIRMORE	1.9(I) 0.8(II)	20	5	0.4	1070	0.4	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 1.1 BCF PRODUCED TO JUNE 30, 1959.
OKOTOKS	WABAMUN	377.0(I) 376.1(II)	10	60(III)	135	980	13.2	(I) ORIGINAL (II) LESS 0.9 BCF PRODUCED TO JUNE 30, 1959. (III) HIGH LOSS DUE TO VERY HIGH ACID GAS CONTENT.
OLDS	WABAMUN	167	10	20	120	1030	124	
OYEN	VIKING	35.4(I) 35.1(II)	25	5	25	980	25	(I) ORIGINAL (II) LESS 0.3 BCF PRODUCED TO JUNE 30, 1959.

TABLE A - 1 (CONT)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FIELD OR AREA	ZONE	ESTIMATED ORIGINAL GAS IN PLACE BCF	RESERVOIR LOSS DISCOUNT PER CENT	SURFACE LOSS DISCOUNT PER CENT	DISPOSABLE GAS(3) BCF	HEATING VALUE(4) BTU PER CU. FT.	DISPOSABLE GAS (1000 BTU BASIS)(3) BCF	REMARKS
PADDLE RIVER	JURASSIC	32.9	20	5	25	1050(E)	26	
	MISSISSIPPIAN	3.9	20	5	3	1040(E)	3	
PARKLAND	MISSISSIPPIAN	26.2	10	15	20	990	20	
PEMBINA	BELLY RIVER	31.7(I) 31.1(II)	15	5	25	1160	29	(I) ORIGINAL (II) LESS 0.6 BCF PRODUCED TO JUNE 30, 1959.
	CARDIUM SOLUTION	1875(I) 1759(II)	60	40	380	1150	437	(I) ORIGINAL (II) LESS 118.7 BCF PRODUCED TO JUNE 30, 1959. INJECTED 3.1 BCF TO JUNE 30TH, 1959. NET PRODUCTION 115.6 BCF.
	BASAL BLAIRMORE	2.8	25	5	2	1290	3	
PENDANT D'OREILLE	BOW ISLAND	216.0(I) 161.1(II)	20	5	112	920	103	(I) ORIGINAL (II) LESS 54.9 BCF PRODUCED TO JUNE 30, 1959.
PENHOLD	VIKING	14.0	10	5	12	1000(E)	12	
PHIL CAN	GETHING	11.8	20	5	9	960(E)	9	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
	MISSISSIPPIAN	5.0	15	5	4	1030(E)	4	
PIGEON LAKE	LEDUC	13.1	10	15	10	1100(E)	11	
PINCHER CREEK	MISSISSIPPIAN	2300(I) 2258.6(II)	14	25	1450	1060	1540	(I) ORIGINAL (II) LESS 54.5 BCF PRODUCED TO JUNE 30, 1959. INJECTED 13.1 BCF TO JUNE 30TH, 1959. NET PRODUCTION 41.4 BCF.
PINE CREEK	LEDUC	926	10	40	500	970	485	
PLAIN LAKE	VIKING	2.8	25	5	2	960(E)	2	
	BLAIRMORE	22.4	20	5	17	980(E)	17	
POUCE COUPE	PEACE RIVER	188.2(I) 166.1(II)	10	5	140	980	137	(I) ORIGINAL (II) LESS 22.1 BCF PRODUCED TO JUNE 30, 1959.
	CADOMIN	12.4	15	5	10	1040(E)	10	

TABLE A - 1 (CONT)

(1) FIELD OR AREA	(2) ZONE	(3) ESTIMATED ORIGINAL GAS IN PLACE BCF	(4) RESERVOIR LOSS DISCOUNT PER CENT	(5) SURFACE LOSS DISCOUNT PER CENT	(6) DISPOSABLE GAS(3) BCF	(7) HEATING VALUE(4) BTU PER CU. FT.	(8) DISPOSABLE GAS (1000 BTU BASIS)(3) BCF	(9) REMARKS
POUCE COUPE SOUTH	PEACE RIVER	182.7(I) 160.6(II)	10	5	135	1020	138	(I) ORIGINAL (II) LESS 22.1 BCF PRODUCED TO JUNE 30, 1959.
	GETHING	14.0	10	5	12	980(E)	12	
	CADOMIN	56.2(I) 55.1(II)	10	5	47	1040(E)	49	(I) ORIGINAL (II) LESS 1.1 BCF PRODUCED TO JUNE 30, 1959.
	JURASSIC	3.9	15	10	3	1050(E)	3	
	TRIASSIC	24.8	15	5	20	1070(E)	21	
PREVO	MISSISSIPPIAN	49.4	10	10	40	1100(E)	44	
PRINCESS	BOW ISLAND	6.6	20	5	5	1020	5	
	BASAL COLORADO	39.9(I) 39.6(II)	20	5	30	1000	30	(I) ORIGINAL (II) LESS 0.3 BCF PRODUCED TO JUNE 30, 1959.
	BASAL BLAIRMORE	163.2(I) 161.2(II)	15	5	130	1010	131	(I) ORIGINAL (II) LESS 2.0 BCF PRODUCED TO JUNE 30, 1959.
	RUNDLE ASSOCIATED	7.9(I) 6.9(II)	20	5	5	1030	5	(I) ORIGINAL (II) LESS 1.0 BCF PRODUCED TO JUNE 30, 1959.
	JEFFERSON ASSOCIATED	45.4(I) 42.1(II)	20	15	28	1010	28	(I) ORIGINAL (II) LESS 3.3 BCF PRODUCED TO JUNE 30, 1959.
PROVOST	VIKING	737.0(I) 716.4(II)	20	5	540	1020	550	(I) ORIGINAL (II) LESS 20.6 BCF PRODUCED TO JUNE 30, 1959.
	BLAIRMORE	18.6	15	5	15	1030	15	
REDWATER	VIKING	14.9(I) 14.2(II)	25	5	10	1020	10	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 0.7 BCF PRODUCED TO JUNE 30, 1959.
	LEDUC SOLUTION	205(I) 172(II)	40	50	45	1200(E)	~~54~~	(I) ORIGINAL (II) LESS 33.0 BCF PRODUCED TO JUNE 30, 1959.
ROCHESTER	VIKING	5.3	20	5	4	980(E)	4	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
	BLAIRMORE	26.7	25	5	19	980	19	
	WABAMUN	5.8	10	5	5	1050(E)	5	

TABLE A - 1 (CONT)

(1) FIELD OR AREA	(2) ZONE	(3) ESTIMATED ORIGINAL GAS IN PLACE BCF	(4) RESERVOIR LOSS DISCOUNT PER CENT	(5) SURFACE LOSS DISCOUNT PER CENT	(6) DISPOSABLE GAS[3] BCF	(7) HEATING VALUE[4] BTU PER CU. FT.	(8) DISPOSABLE GAS (1000 BTU BASIS)[3] BCF	(9) REMARKS
ROLLING HILLS	BOW ISLAND	26.0	15	5	21	950(E)	20	
	BASAL COLORADO	7.4	15	5	6	1010(E)	6	
ROSEBUD	VIKING	11.7	10	5	10	980(E)	10	
RYCROFT	GETHING ASSOCIATED AND NON-ASSOCIATED	16.1(I) 14.0(II)	15	5	11	1020	11	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 2.1 BCF PRODUCED TO JUNE 30, 1959.
ST. ALBERT	VIKING	2.6	20	5	2	1010	2	
	LOWER CRETACEOUS	43.2(I) 19.0(II)	10	5	14	1075	15	(I) ORIGINAL (II) LESS 24.2 BCF PRODUCED TO JUNE 30, 1959.
ST. BRIDES	BLAIRMORE ASSOCIATED AND NON-ASSOCIATED	26.3	20	5	20	920(E)	18	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
ST. PAUL	BLAIRMORE	2.7(I) 0.8(II)	20	5	0.3	990	0.3	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 1.9 BCF PRODUCED TO JUNE 30, 1959.
SADDLE HILLS	PEACE RIVER	41.0	10	5	35	1000	35	
	GETHING	2.3	10	5	2	960(E)	2	
	PERMO-PENN	23.4	10	5	20	1010(E)	20	
SAMSON	BASAL BLAIRMORE ASSOCIATED AND NON-ASSOCIATED	15.8(I) 14.3(II)	20	10	10	1020	10	(I) ORIGINAL (II) LESS 1.5 BCF PRODUCED TO JUNE 30, 1959.
SARCEE	MISSISSIPPIAN	181	10	20	130	1030	134	
SAVANNA CREEK	MISSISSIPPIAN	815	10	25	550	980	539	
SIBBALD	VIKING	46.8(I) 46.2(II)	20	5	35	1010	35	(I) ORIGINAL (II) LESS 0.6 BCF PRODUCED TO JUNE 30, 1959.
	BLAIRMORE	5.3	20	5	4	970	4	

TABLE A - 1 (CONT)

(1) FIELD OR AREA	(2) ZONE	(3) ESTIMATED ORIGINAL GAS IN PLACE BCF	(4) RESERVOIR LOSS DISCOUNT PER CENT	(5) SURFACE LOSS DISCOUNT PER CENT	(6) DISPOSABLE GAS[3] BCF	(7) HEATING VALUE[4] BTU PER CU. FT.	(8) DISPOSABLE GAS (1000 BTU BASIS)[3] BCF	(9) REMARKS
SMITH COULEE	BOW ISLAND	67.7(I) 64.8(II)	20	5	48	910	44	(I) ORIGINAL (II) LESS 2.9 BCF PRODUCED TO JUNE 30, 1959.
STETTLER	VIKING	4.2	25	5	3	1000(E)	3	
	NISKU SOLUTION	27.4(I) 25.0(II)	45	45	7	1110	8	(I) ORIGINAL (II) LESS 2.4 BCF PRODUCED TO JUNE 30, 1959.
	LEDUC SOLUTION	12.2(I) 11.0(II)	45	45	3	1120	3	(I) ORIGINAL (II) LESS 1.2 BCF PRODUCED TO JUNE 30, 1959.
STOLBERG	MISSISSIPPIAN	86.4	10	10	70	1020	71	
STURGEON LAKE	LEDUC SOLUTION	43.9(I) 42.2(II)	40	35	16	1050	17	(I) ORIGINAL (II) LESS 1.7 BCF PRODUCED TO JUNE 30, 1959. PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
STURGEON LAKE SOUTH	GETHING	16.1	15	5	13	980(E)	13	
	CADOMIN	11.1	15	5	9	1040(E)	9	
	TRIASSIC ASSOCIATED	4.7	10	5	4	1160	3	
	TRIASSIC SOLUTION	25.1(I) 24.8(II)	35	25	12	1160	14	(I) ORIGINAL (II) LESS 0.3 BCF PRODUCED TO JUNE 30, 1959.
	WABAMUN	7.4	10	25	5	1050(E)	5	
	LEDUC ASSOCIATED	7.4	10	25	5	1060	5	
	LEDUC SOLUTION	221.0(I) 212.6(II)	35	35	88	1060	93	(I) ORIGINAL (II) LESS 8.4 BCF PRODUCED TO JUNE 30, 1959.
STURGEON LAKE SOUTH GENERAL AREA	GETHING	61.9	15	5	50	980(E)	49	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
	TRIASSIC	6.2	15	5	5	1160(E)	6	
	PERMO-PENN	2.6	20	5	2	1010(E)	2	
SUFFIELD	MILK RIVER	45.5(I) 42.9(II)	25	5	30	960	29	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 2.6 BCF PRODUCED TO JUNE 30, 1959.

TABLE A - 1 (CONT)

(1) FIELD OR AREA	(2) ZONE	(3) ESTIMATED ORIGINAL GAS IN PLACE BCF	(4) RESERVOIR LOSS DISCOUNT PER CENT	(5) SURFACE LOSS DISCOUNT PER CENT	(6) DISPOSABLE GAS(3) BCF	(7) HEATING VALUE(4) BTU PER CU. FT.	(8) DISPOSABLE GAS (1000 BTU BASIS)(3) BCF	(9) REMARKS
SUNDRE	VIKING	17.5	10	5	15	1000(E)	15	
	BASAL BLAIRMORE	24.7	10	10	20	1000(E)	20	
	MISSISSIPPIAN NON-ASSOCIATED	13.1	10	15	10	1050(E)	11	
	MISSISSIPPIAN ASSOCIATED	19.6	10	15	15	1050(E)	16	
	MISSISSIPPIAN SOLUTION	61.6(I) 58.4(II)	40	20	27	1080	29	(I) ORIGINAL (II) LESS 3.2 BCF PRODUCED TO JUNE 30, 1959.
SWAN HILLS	BEAVERHILL LAKE SOLUTION	833(I) 832.7(II)	40	30	350	1100	385	(I) ORIGINAL (II) LESS 0.3 BCF PRODUCED TO JUNE 30, 1959.
SYLVAN LAKE	BASAL BLAIRMORE	80.2	10	10	65	1080	70	
	MISSISSIPPIAN	55.5	10	10	45	1080	49	
	DEVONIAN ASSOCIATED	5.6	10	20	4	1100(E)	4	
TANGENT	CADOTTE	15.0	30(I)	5	10	990	10	(I) HIGH LOSS DUE TO LOW RESERVOIR PRESSURE.
	GETHING	130.1	15	5	105	980(E)	103	
	TRIASSIC	65.8	20	5	50	1160(E)	58	
THREE HILLS CREEK	BELLY RIVER	8.7	15	5	7	950(E)	7	
	VIKING	7.9	20	5	6	980(E)	6	
	MISSISSIPPIAN	185	10	10	150	1140	171	
TURIN	BOW ISLAND	5.0	15	5	4	950(E)	4	
	BASAL BLAIRMORE	21.1	10	5	18	1000	18	
	ELLIS	5.0	15	5	4	1050(E)	4	
	MISSISSIPPIAN	2.8	10	20	2	1030(E)	2	
TURNER VALLEY	RUNDLE ASSOCIATED	-	-	20	188	1090	205	AFTER DEDUCTING PRODUCTION TO JUNE 30, 1959.
	RUNDLE SOLUTION	-	-	38	115	1090	125	AFTER DEDUCTING PRODUCTION TO JUNE 30, 1959.
TWO CREEK	TRIASSIC	11.7	10	5	10	1070(E)	11	
USONA	LOWER CRETACEOUS	11.7	10	5	10	1090	11	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.

TABLE A - 1(CONT)

(1) FIELD OR AREA	(2) ZONE	(3) ESTIMATED ORIGINAL GAS IN PLACE BCF	(4) RESERVOIR LOSS DISCOUNT PER CENT	(5) SURFACE LOSS DISCOUNT PER CENT	(6) DISPOSABLE GAS[3] BCF	(7) HEATING VALUE[4] BTU PER CU. FT.	(8) DISPOSABLE GAS (1000 BTU BASIS)[3] BCF	(9) REMARKS
VIKING-KINSELLA	VIKING	1060(I) 739(II)	25	5	450	970	436	(I) ORIGINAL (II) LESS 322.5 BCF PRODUCED TO JUNE 30, 1959. INJECTED 0.7 BCF TO JUNE 30TH, 1959. NET PRODUCTION 321.2 BCF.
	BLAIRMORE	21.1(I) 17.9(II)	15	5	14	980	14	(I) ORIGINAL (II) LESS 3.2 BCF PRODUCED TO JUNE 30, 1959.
	DEVONIAN	5.3	20	5	4	990	4	
VIRGINIA HILLS	BLAIRMORE	9.4	10	5	8	1020(E)	8	
	BEAVERHILL LAKE SOLUTION	4.7	35	35	2	1100(E)	2	
	SLAVE POINT	3.3	25	20	2	1050(E)	2	
WAINWRIGHT	VIKING	5.3	20	5	4	960(E)	4	
	BLAIRMORE	17.4(I) 14.0(II)	20	5	10	920	9	(I) ORIGINAL (II) LESS 3.4 BCF PRODUCED TO JUNE 30, 1959.
WARBURG	BASAL BELLY RIVER	3.5	10	5	3	1060	3	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
	VIKING	10.5	10	5	9	1160	10	
WATERGLEN	BLAIRMORE	6.5	15	10	5	1100(E)	6	
	LEDUC	9.7	10	20	7	1100(E)	8	
WATERTON	MISSISSIPPIAN	1670	10	50(I)	750	990	742	(I) HIGH LOSS DUE TO VERY HIGH ACID GAS CONTENT.
	DEVONIAN	278	10	20	200	1000(E)	200	
WATTS	VIKING	1.9(I) 1.3(II)	20	5	0.9	1020	0.9	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 0.6 BCF PRODUCED TO JUNE 30, 1959.
	MISSISSIPPIAN	1.3	20	5	1	1050(E)	1	
WAYNE-ROSEDALE	VIKING	65.8	20	5	50	980	49	
	BLAIRMORE NON-ASSOCIATED	71.3(I) 70.4(II)	10	5	60	1070	64	(I) ORIGINAL (II) LESS 0.9 BCF PRODUCED TO JUNE 30, 1959.
	BASAL BLAIRMORE ASSOCIATED	12.3	10	10	10	1030	10	
	BASAL BLAIRMORE SOLUTION	27.8(I) 27.4(II)	35	15	15	1040	16	(I) ORIGINAL (II) LESS 0.4 BCF PRODUCED TO JUNE 30, 1959.

TABLE A - 1 (CONT)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FIELD OR AREA	ZONE	ESTIMATED ORIGINAL GAS IN PLACE BCF	RESERVOIR LOSS DISCOUNT PER CENT	SURFACE LOSS DISCOUNT PER CENT	DISPOSABLE GAS[3] BCF	HEATING VALUE[4] BTU PER CU. FT.	DISPOSABLE GAS (1000 BTU BASIS)[3] BCF	REMARKS
WEST DRUMHELLER	BASAL BLAIRMORE	12.4	15	5	10	1120	11	
	NISKU ASSOCIATED	9.1	10	15	7	1160(E)	8	
	NISKU SOLUTION	31.4(I) 27.0(II)	45	25	10	1070	11	(I) ORIGINAL (II) LESS 4.0 BCF PRODUCED TO JUNE 30, 1959.
	LEDUC SOLUTION	2.7(I) 2.4(II)	40	25	1	1100	1	(I) ORIGINAL (II) LESS 0.3 BCF PRODUCED TO JUNE 30, 1959.
WESTEROSE	BLAIRMORE	6.6	20	5	5	1000(E)	5	
	LEDUC ASSOCIATED	125	10	20	90	1050(E)	95	
	LEDUC SOLUTION	119.2(I) 115.7(II)	30	25	60	1080	64	(I) ORIGINAL (II) LESS 6.9 BCF PRODUCED TO JUNE 30, 1959. INJECTED 3.4 BCF TO JUNE 30TH, 1959. NET PRODUCTION 3.5 BCF.
WESTEROSE SOUTH	LEDUC	1500	10	15	1150	1070	1230	
WESTLOCK	VIKING	250.0(I) 248.4(II)	15	5	200	1020	204	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 1.6 BCF PRODUCED TO JUNE 30, 1959.
	BASAL BLAIRMORE	2.6	20	5	2	1100(E)	2	
WEST PRAIRIE	CADOTTE	17.5	10	5	15	1020(E)	15	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
	BLUESKY	5.9	10	5	5	970	5	
WESTWARD HO	MISSISSIPPIAN NON-ASSOCIATED	39.2	10	15	30	1050	31	
	MISSISSIPPIAN SOLUTION	38.6(I) 36.2(II)	35	25	17	1110	19	(I) ORIGINAL (II) LESS 2.4 BCF PRODUCED TO JUNE 30, 1959.
WHITELAW	GETHING	38.5(I) 36.3(II)	15	5	29	1000	29	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 2.2 BCF PRODUCED TO JUNE 30, 1959.
	TRIASSIC	32.9	20	5	25	1070(E)	27	
WILDCAT HILLS	MISSISSIPPIAN	347	10	20	250	1030(E)	258	
WILDMERE	BLAIRMORE	13.5(I) 6.3(II)	20	5	3.4	940	3.2	SUPPLIES LOCAL UTILITY. (I) ORIGINAL (II) LESS 7.2 BCF PRODUCED TO JUNE 30, 1959.

TABLE A-1 (CONT)

(1) FIELD OR AREA	(2) ZONE	(3) ESTIMATED ORIGINAL GAS IN PLACE BCF	(4) RESERVOIR LOSS DISCOUNT PER CENT	(5) SURFACE LOSS DISCOUNT PER CENT	(6) DISPOSABLE GAS[3] BCF	(7) HEATING VALUE[4] BTU PER CU. FT.	(8) DISPOSABLE GAS (1000 BTU BASIS)[3] BCF	(9) REMARKS
WILDUNN CREEK	VIKING	19.7	20	5	15	990	15	
WILLINGDON	VIKING	5.6	25	5	4	960(E)	4	
	BLAIRMORE	9.2	20	5	7	970	7	
	DEVONIAN	7.0	10	5	6	970	6	
WIMBORNE	VIKING	1.4	25	5	1	1000(E)	1	
	NISKU ASSOCIATED	2.8	15	15	2	1160(E)	2	
	LEDUC ASSOCIATED	397	10	30	250	920	230	
	LEDUC SOLUTION	70.8(I) 69.8(II)	35	60(III)	18	1000(E)	18	(I) ORIGINAL (II) LESS 1.0 BCF PRODUCED TO JUNE 30, 1959. (III) HIGH LOSS DUE TO VERY HIGH ACID GAS CONTENT.
WINDFALL	VIKING	14.0	25	5	10	1010(E)	10	
	LEDUC ASSOCIATED AND SOLUTION	547	10	35	320	1040	333	
WIZARD LAKE	VIKING	2.5	15	5	2	1050(E)	2	
	BASAL BLAIRMORE ASSOCIATED	8.2	10	5	7	1100	8	
	LEDUC SOLUTION	234.3(I) 222.1(II)	40	30	90	1230	111	(I) ORIGINAL (II) LESS 12.2 BCF PRODUCED TO JUNE 30, 1959.
WOOD RIVER	BASAL BLAIRMORE	46.8	10	5	40	1130	45	
WORSLEY	LEDUC	62.5	10	20	45	1050(E)	47	PRESENTLY CONSIDERED BEYOND ECONOMIC REACH.
WITHIN ECONOMIC REACH					25,375.8		26,206.5	
BEYOND ECONOMIC REACH					592.0		609.0	
				SUB TOTAL	25,967.8		26,815.5	
OTHER RESERVES (WITHIN ECONOMIC REACH					202.0		202.0	
LESS THAN 10 BCF (BEYOND ECONOMIC REACH					711.0		711.0	
				TOTAL RESERVES, (SEPTEMBER 30, 1959)	26,880.8		27,728.5	

GENERAL NOTES:

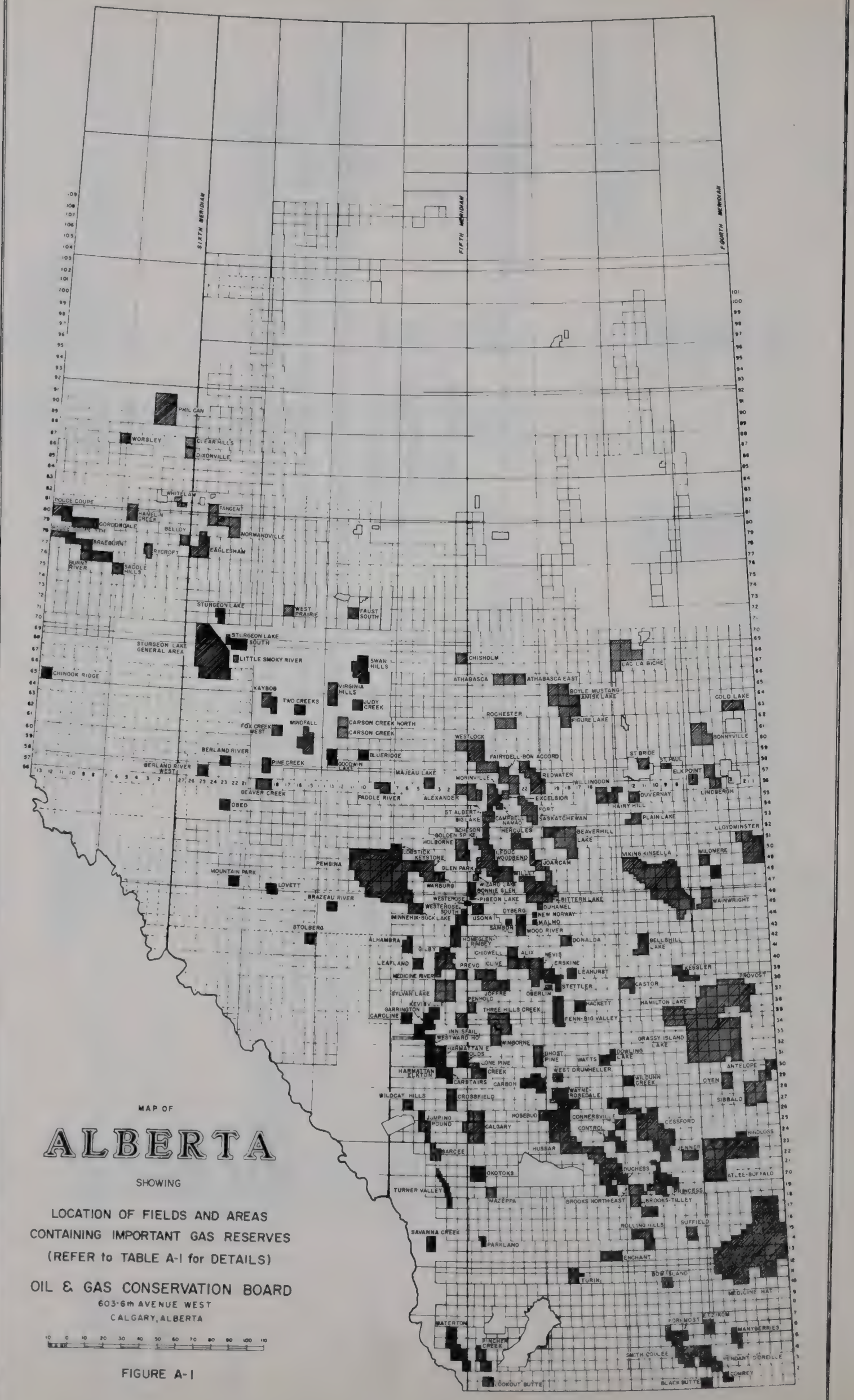
1. UNLESS OTHERWISE NOTED RESERVOIR LOSS IS CALCULATED AS 10% OF ORIGINAL GAS IN PLACE EXCEPT IN PARTICULAR CASES WHERE THE FOLLOWING LOSSES PERTAIN:

SAND THICKNESS 10 - 15 FEET	RESERVOIR LOSS - 15%
SAND THICKNESS 5 - 10 FEET	RESERVOIR LOSS - 20%
SAND THICKNESS 0 - 5 FEET	RESERVOIR LOSS - 25%

2. SURFACE LOSSES TAKEN AS 5% FOR ALL DRY GAS, AND VARIES FOR WET AND SOUR GAS DEPENDING UPON ITS COMPOSITION.

3. THE DISPOSABLE RESERVES AS AT SEPTEMBER 30, 1959 WITH PRODUCTION DEDUCTED TO JUNE 30TH, 1959, ONLY.

4. HEATING VALUE IS HIGHER HEATING VALUE BASED ON AVAILABLE GAS ANALYSES AND ADJUSTED FOR PROCESSING SHRINKAGE WHERE REQUIRED. WHERE NO ANALYSES ARE AVAILABLE BTU VALUES HAVE BEEN BASED ON ANALYSES OF SIMILAR TYPE RESERVOIRS AND SHOWN AS (E).



MAP OF

ALBERTA

SHOWING

LOCATION OF FIELDS AND AREAS
CONTAINING IMPORTANT GAS RESERVES
(REFER to TABLE A-1 for DETAILS)

OIL & GAS CONSERVATION BOARD
603-6th AVENUE WEST
CALGARY, ALBERTA

10 0 10 20 30 40 50 60 70 80 90 100 110

FIGURE A-1

DECEMBER 1959

APPENDIX B

THE TRENDS IN EXPLORATION FOR AND THE GROWTH OF RESERVES OF GAS IN ALBERTA

There are two general methods that have been used by estimators in forecasting trends in the growth of reserves of oil or natural gas; the geological method and statistical method. The geological method consists of determining the total volume of available sediments and applying certain accumulation factors. No new information of this kind has been presented to the Board since publication of its September, 1958, report. The estimates presented in that report of ultimate reserves of recoverable gas in the Province ranged from 60 to 102 trillion cubic feet.

Forecast Based on the Statistical Method

An intensive study of the statistical method of estimating the growth of reserves in the Province of Alberta has been prepared for this report. This method has been used in previous Board reports and was presented in an extended form in the September, 1958, report. Data on exploratory drilling, the volume of disposable gas reserves and the appreciation of new discoveries are employed in establishing trends that can be used in forecasting the future growth of reserves.

The reserve estimates reported in Appendix A have been converted to a 1,000 Btu equivalent basis. Due, however, to the large amount of historical data used in the development of certain trends presented in Appendix B, reserve estimates on an actual Btu or as produced basis are used. Since the

total converted reserves for the Province are only about 3 per cent greater than the unconverted reserves, the results of the analysis of the trends may be applied for predicting the growth of reserves having an average heating value of 1,000 Btu per standard cubic foot.

Two reports on trends and the appreciation of reserves were presented to the Board during the Alberta and Southern hearing in October, 1959. The methods employed and resulting conclusions are discussed below.

Submission of Alberta and Southern

Mr. S. R. Blair presented a report entitled "Statistical Review and Forecast of Reserve Appreciation in Southwestern Alberta" in support of the application of Alberta and Southern. Reserve appreciation was defined as "the increase in established reserve estimates occurring subsequent to the initial estimate". Three different procedures were used by Mr. Blair to forecast reserve appreciation to the end of 1961 in fields under permit to Alberta and Southern.

The area used in the study lay west of the 5th Meridian and south of Township 65. Reserve growth from appreciation was forecast by

(a) extrapolation of historical data on the rates of increase in reserves due to appreciation,

(b) statistical analysis of historical data in a method similar to that used by the Board in its September, 1958, report, and

(c) analysis of the percentage increase of subsequent reserve estimates over the original estimate.

The total rate of increase in reserves in the area under study was subdivided into that due to new discoveries and that due to appreciation. It was found that the discovery rate had been accelerating consistently since 1954 and had grown to 1.7 trillion cubic feet per year by the end of 1958. The rate of reserve appreciation had also risen during this period to a value of 1.1 trillion cubic feet per year. Both the discovery rate and the appreciation rate were conservatively forecasted at 1 trillion cubic feet per year for the next three years. Alberta and Southern, having about 60 per cent of the reserves in this area, expect some 1.8 trillion cubic feet of the forecasted total appreciation of 3 trillion cubic feet to occur in fields under permit or committed to them.

The statistical approach indicated that an original estimate of reserves would increase by some 3 trillion cubic feet when the reserves contained in that estimate were fully evaluated some five or six years later. The average increase at three years from the date of the original estimate was taken as 2.6 trillion cubic feet. Since the forecast by the previous method of 3 trillion cubic feet allowed for some appreciation of estimated 1959 discoveries, while the forecast by the second method does not, the two figures are in general agreement. It was assumed that the appreciation would occur mainly in reserves first estimated in 1956 through 1958, of which Alberta and Southern have about 70 per cent under permit. Therefore,

appreciation of their reserves during the next three years was forecasted at 70 per cent of 2.6 trillion cubic feet or 1.8 trillion cubic feet.

The third method employed was based on the percentage increase of subsequent reserve estimates over the corresponding original estimate, and is similar to the method adopted and elaborated upon by the Board in this report. A weighted average percentage curve was used to forecast the reserves as of December 31, 1961, in certain fields under permit to the applicant. The resulting expected appreciation in the three year period December, 1958, to December 1961, was 2.9 trillion cubic feet. Since this method was used to forecast appreciation on a field by field basis for a small number of fields, rather than on a general area basis, the results are questionable and, in this case, are considered to be high. Mr. Blair also noted in his conclusions that the results obtained by the first two methods were the more reliable.

In its own studies (described later) the Board has found that the growth in reserves in the Province due solely to appreciation of previous discoveries over a three year period would normally average about 4.7 trillion cubic feet. Having regard to the nature and size of the area covered by the Board's study, Mr. Blair's forecasts and the Board's (based on normal expectation) are in good general agreement.

Submission of City of Calgary

On behalf of the City of Calgary, during the course of the Alberta and Southern hearing, Dr. D. L. Flock submitted a

report on reserve appreciation. Referring to the 1958 Report of the Board, Dr. Flock suggested that the Board should discount by 50 per cent the reserves expected from appreciation to account for

(a) non-profitable reserves,

(b) associated and solution gas,

(c) gas used in secondary recovery and gas cycling projects, and

(d) probable reserves already included in the initial estimates.

Dr. Flock calculated the reserve appreciation for the Province for the year 1958 at some 1,270 billion cubic feet based on the data presented in Board reports of September, 1958, and March, 1959. The Board finds that the actual appreciation for the nine-month period between the effective dates of these reports (March 31, 1958, and December 31, 1958) amounted to some 1,300 billion cubic feet which when projected to a full year, would be 1,750 billion cubic feet. Dr. Flock's figure of 1,270 billion cubic feet appears to be in error. This error appears to be the reason why his calculated point was substantially below the average line on Figure B-2 of the 1958 report.

Figure B-2 was intended to show the total appreciation that could normally be expected when the reserves contained in an estimate were fully evaluated at a later date. It is evident from the scattering of the data points that the actual appreciation occurs irregularly and for a particular estimate could deviate considerably from the average curve.

The amount of reserves beyond economic reach at any time is about 5 per cent of the total initial disposable reserves. Since appreciation, by definition, includes only additional reserves due to field development, any appreciation occurring in a reserve originally classified as uneconomic would tend to place that reserve in the economic category. In most cases only new discoveries should be discounted to allow for uneconomic reserves.

Reserves of solution and associated gas are shown as disposable gas and, while not immediately available, are still part of the overall gas reserves. This fact is taken into account in setting illustrative deliverability schedules. The same is true of gas used in secondary recovery and cycling projects. It is not lost nor unrecoverable but merely deferred.

Established reserves, as published in Board reports, are proven reserves plus some fraction of the probable reserves. If future development should prove the probable area, only the increase in reserves due to removal of the previously applied discount factor would be classified as appreciation.

In view of all of the above, the Board cannot agree with the suggestion that a discount factor should be applied to its estimate of future appreciation of known reserves.

Exploratory Drilling and the Growth of Reserves

Table B-1 lists individual gas reserves by year of discovery. The remaining disposable reserves as of September 30, 1959, are corrected to an initial disposable basis by the addition of the total gas marketed to June 30, 1959. Reserves

of 10 billion cubic feet or less, with the exception of those serving local utility systems, are grouped under the heading "Other Small Reserves". Data concerning the annual and cumulative wildcat wells drilled and the currently estimated initial disposable reserves by year of discovery are summarized in Table B-2. Columns 8 and 9 show the annual and cumulative discovery rates per wildcat well. As of September 30, 1959, the drilling of 4,754 wildcat wells (one per every 42 square miles of the 200,000 square miles of potential gas area) has resulted in the discovery of 28,467 billion cubic feet of initial disposable reserves, yielding an overall discovery rate of 6.0 billion cubic feet per wildcat well. The annual rate of discovery for the first nine months of 1959 is 1.3 billion cubic feet per wildcat well. This figure is substantially below the average, partly because the reserves discovered in the first nine months of 1959 have experienced very little, if any, appreciation. Any future appreciation of the presently known reserves will increase both the annual and cumulative discovery rates.

Figure B-1 is a graphical presentation of the data in Table B-1, together with the corresponding data of six previous Board reports. The figure shows the growth of initial disposable reserves and the effect of appreciation of reserves subsequent to the original estimate. The dashed line through the final reserve estimates shows the overall trend in the growth of initial disposable reserves from all reasons -- appreciation of all previous discoveries, new discoveries and appreciation

of new discoveries. The overall growth has been remarkably consistent at about 2.9 trillion cubic feet per year.

Figure B-2 is a plot of the annual and cumulative discovery rates as summarized in Table B-2. The adjusted lines show the result of anticipated future appreciation and are discussed in detail later.

Time Lag in Evaluation of Reserves

Referring to Figure B-1, it can be seen that a time lag of several years occurs before the fields and areas evaluated in a given reserve estimate are fully developed. The report of September, 1958, indicated that a reserve estimate for the Province could be expected to have increased by some $4\frac{1}{2}$ trillion cubic feet when the reserves contained in that estimate were fully developed some six to seven years after their dates of discovery. When the data now available is treated in a similar manner, it is evident that the total appreciation that could be expected in recent reserve estimates is larger than actual appreciation of the earlier estimates. In other words, the appreciation that can be expected is a function of the amount of the reserves under development and not merely the elapsed time from discovery. In addition to this fact, there had been some confusion in interpreting certain figures in the September, 1958, report which were intended to show the amount of future appreciation that could be expected from known reserves, taking into account the elapsed time from discovery to latest evaluation. Therefore, the Board believed that the trend data should be reviewed and the presentation clarified.

Percentage Appreciation of Reserves

Various methods of relating the actual appreciation of reserves to the elapsed time from discovery were explored. The method developed for this report consists of evaluating the percentage appreciation of reserves from the year of discovery. The reserves discovered in each of the years 1951 to 1958, as estimated in the seven Board reports, are tabulated in Table B-3 and shown in Figure B-3. The average date of discovery was arbitrarily taken as the mid-point in the discovery year. For example, reserves discovered in the year 1957 and estimated as of September 30, 1959, were considered to have undergone two and one-quarter years of appreciation. Since the reserves are grouped by year of discovery, an original estimate made at some date other than December 31 and containing only part of the reserves discovered in that year is not comparable with subsequent estimates which contain all the reserves discovered in that year. Therefore, the reserves one year from the average date of discovery, as estimated or interpolated from Figure B-3, were used as a base and the percentage increases of estimates for subsequent years over that for the first year were calculated and plotted. Table B-4 gives the annual reserves after one to seven years of appreciation and the corresponding percentages. This information was plotted on Figure B-4, together with a weighted average curve. It was recognized that the average or normal appreciation curve did not reflect the scattering of the data and, therefore, two other curves were added to Figure B-4 to represent a high and a low expectation of reserve appreciation.

The corresponding reserve appreciation ratios were derived from the curves on Figure B-4 and are presented as Figure B-5. These reserve appreciation ratios can be used to adjust a current reserve estimate to obtain the anticipated fully evaluated reserve. Figures B-4 and B-5 were prepared using all the reserves discovered in the Province since January 1, 1951, and should not be used to evaluate a single reserve or a small group of reserves without taking into account the actual amount of development drilling that has taken place. It should also be used with caution when dealing with reserves less than one year old.

Forecast of Ultimate Appreciation of Known Reserves

The growth of cumulative initial disposable reserves as related to cumulative number of wildcat wells drilled is shown on Figure B-6. The upper portion of this graph has been reproduced on a larger scale and is presented as Figure B-7. The annual reserves, as currently estimated were adjusted using both the normal and low appreciation ratios from Figure B-5 and shown as columns 6 and 7 of Table B-5. The cumulative and annual discovery rates per wildcat well were also adjusted accordingly. The adjusted discovery rates based on the normal appreciation curve were plotted on Figure B-2 as lines ABC' and DEF'. It can be seen from column 13 of the table or from line ABC' of the figure that the average adjusted cumulative discovery rate for the past eight years is approximately 7 billion cubic feet per wildcat well. This compares with the Board's previous interpretation of 6 billion cubic feet.

The cumulative ultimate adjusted reserves based on normal appreciation are plotted on Figures B-6 and B-7 and are represented as the points enclosed in small triangles. A best fit straight line was drawn through those points having a slope equivalent to a discovery rate of slightly less than 7.0 billion cubic feet per wildcat well. This line was extrapolated to 7,000 wildcat wells and then arbitrarily reduced to give an ultimate reserve figure of some 90 trillion cubic feet by the time 20,000 wildcats (equivalent to one well for every ten square miles of potential gas area) are drilled. The cumulative adjusted reserves based on low appreciation were treated in a similar manner as represented on Figure B-7 by the lower curve. These extrapolations have a greater slope and are slightly above the line DEH of Figure B-9 of the September, 1958, report.

Trends in Exploratory Drilling

The average number of exploratory wells drilled per year over the past seven and three-quarter years is 399. This compares with the previous forecast of 400 wells per year. It has been assumed that the cumulative number of wildcat wells drilled to the end of 1959 would be 4,860 and that exploratory drilling would continue normally thereafter at an average rate of 400 wells per year for the next ten years. For a more conservative projection of reserve growth, the Board has also used an average rate of exploratory drilling of 300 wells per year during the next decade.

Forecast of Future Additional Reserves

Using the extrapolated lines of Figure B-7 and an assumed exploratory drilling rate it is therefore possible to predict the cumulative ultimate reserves as of the end of any year in the next decade. The difference between any two successive year-end estimates corresponds to the final assessment of reserves discovered in that year. Knowing this ultimate figure for any year and assuming that it takes about seven years before a group of reserves are fully assessed, it is then possible to predict, using Figure B-5, what the reserves would be at any time during this period of development.

Employing the methods mentioned in previous sections, two year by year forecasts were prepared showing the anticipated reserve estimates as of December 31st for the ten year period 1960-1969 inclusive. The first forecast was based on normal appreciation and assumed an average exploratory drilling rate of 400 wildcat wells per year; the second was based on low appreciation and 300 wells per year. These data are presented as Table B-6 and B-7, respectively.

The tables are divided into two sections; one showing additional reserves due to appreciation of known reserves, and the other showing additional reserves due to new discoveries and the appreciation of these new discoveries. From Table B-6 it may be seen that known reserves, which are presently estimated at 28,467 billion cubic feet, are expected to appreciate some 6,030 billion cubic feet to an ultimate figure

of 34.5 trillion cubic feet by 1966 when fully appreciated. Cumulative future discoveries are expected to total some 5,950 billion cubic feet and the appreciation of these discoveries to total 14,350 billion cubic feet for a grand total of 20.3 trillion cubic feet by the end of 1969. This amount of new reserves, together with the appreciation of known reserves, results in some 26 trillion cubic feet of additional reserves expected in the next ten years. This information is presented graphically as Figure B-8.

Similarly, from Table B-7, the ultimate appreciation of known reserves is expected to be about 4,630 billion cubic feet. New discoveries are expected to total some 15.7 trillion cubic feet for a grand total of about 20 trillion cubic feet of additional reserves in the next decade. These data are also presented as Figure B-9. This latter forecast is considered by the Board to be a safe and ultra-conservative projection of the additional reserves that can be expected in the immediate future.

TABLE B - 1

OIL AND GAS CONSERVATION BOARD

TRENDS IN WILDCAT DRILLING AND GROWTH OF DISPOSABLE GAS RESERVES IN THE PROVINCE OF ALBERTA

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
YEAR	WILDCAT WELLS PER YEAR	WILDCAT WELLS CUMULATIVE	NAME OF GAS RESERVE DISCOVERED	REMAINING DISPOSABLE GAS RESERVES AS OF SEPTEMBER 30, 1959 BCF	CUMULATIVE GAS MARKETED TO JUNE 30, 1959 BCF	INITIAL DISPOSABLE GAS RESERVES BCF	CUMULATIVE INITIAL DISPOSABLE GAS RESERVES BCF
PRIOR TO 1930		172	MEDICINE HAT (MEDICINE HAT AND BOW ISLAND), BOW ISLAND, BROOKS-TILLEY, VIKING-KINSELLA (VIKING), FOREMOST, POUCE COUPE, TURNER VALLEY, WAINWRIGHT	2498	998.2	3496.2	3496
1930 TO 1940	132	304	LLOYDMINSTER, WILDMERE, PRINCESS	205.8	15.9	221.7	
			OTHER SMALL RESERVES	7	-	7	3725
1941	20	324	SUFFIELD	30	2.5	32.5	3757
1942	43	367	JENNER	12	-	12	
			OYEN	25	0.3	25.3	
			OTHER SMALL RESERVES	1	-	1	3796
1943	34	401	ATHABASCA (LOWER CRETACEOUS)	2.9	1.0	3.9	3800
1944	56	457	BLACK BUTTE	30	11.5	41.5	
			JUMPING POUND	480	104.1	584.1	4425
1945	56	513	OTHER SMALL RESERVES	4	-	4	4429
1946	54	567	BEAVERHILL LAKE (VIKING)	130	0.4	130.4	
			BROOKS NORTH-EAST (SUNBURST)	9	0.9	9.9	
			LINDBERGH	9.7	2.6	12.3	
			PENDANT D'OREILLE	112	52.9	164.9	
			PROVOST	555	19.5	574.5	5321
1947	71	638	FAIRYDELL-BON ACCORD	105	6.2	111.2	
			LEDUC-WOODBEND	503	100.9	603.9	
			MANYBERRIES	47	8.8	55.8	
			MEDICINE HAT (ELLIS)	20	-	20	
			ST. PAUL	0.3	1.7	2.0	
			SMITH COULEE	48	2.8	50.8	
			OTHER SMALL RESERVES	7	-	7	6172
1948	126	764	BROOKS NORTH-EAST (BOW ISLAND)	10	-	10	
			DOWLING LAKE	0.1	0.4	0.5	
			ELK POINT	2.7	0.5	3.2	
			MORINVILLE	92	21.6	113.6	
			PINCHER CREEK	1450	16.8	1466.8	
			REDWATER	55	2.9	57.9	
			OTHER SMALL RESERVES	7	-	7	7831

TABLE B - 1 (CONT)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
YEAR	WILDCAT WELLS PER YEAR	WILDCAT WELLS CUMULATIVE	NAME OF GAS RESERVE DISCOVERED	REMAINING DISPOSABLE GAS RESERVES AS OF SEPTEMBER 30, 1959 BCF	CUMULATIVE GAS MARKETED TO JUNE 30, 1959 BCF	INITIAL DISPOSABLE GAS RESERVES BCF	CUMULATIVE INITIAL DISPOSABLE GAS RESERVES BCF
1949	209	973	BONNYVILLE	2.8	1.0	3.8	
			BOYLE-MUSTANG-AMISK LAKE	10	-	10	
			CAMPBELL-NAMAO	37	-	37	
			CASTOR	20	-	20	
			CESSFORD	1360	17.1	1377.1	
			EXCELSIOR	40	-	40	
			GOLDEN SPIKE	96	-	96	
			JOARCAM	63	-	63	
			LAC LA BICHE	44	-	44	
			NORMANDVILLE (BLUESKY)	10	0.0	10.0	
			OBERLIN	0.8	1.0	1.8	
			PLAIN LAKE	19	-	19	
			ROCHESTER	28	-	28	
			STETTLER	13	0.5	13.5	
			WESTLOCK (VIKING)	200	1.5	201.5	
			WILLINGDON	17	-	17	
			OTHER SMALL RESERVES	53	-	53	9866
1950	224	1197	ACHESON	65	2.0	67.0	
			ATHABASCA EAST	1.1	0.5	1.6	
			COUNTESS	54	-	54	
			DUHAMEL	11	-	11	
			FENN-BIG VALLEY	77	2.4	79.4	
			LEAHURST	6.6	0.6	7.2	
			ROLLING HILLS (BOW ISLAND)	21	-	21	
			SIBBALD	39	0.6	39.6	
			TURIN (MISSISSIPPIAN)	2	-	2	
			WHITELAW	54	2.1	56.1	
			OTHER SMALL RESERVES	52	-	52	10257
1951	461	1658	ATHABASCA (WABAMUN)	3	-	3	
			ATLEE-BUFFALO (VIKING)	70	0.4	70.4	
			BELLOY (MISSISSIPPIAN)	15	-	15	
			BONNIE GLEN	550	18.2	568.2	
			CLIVE	16	-	16	
			DUCHESS	19	-	19	
			ETZIKOM, (BOW ISLAND)	65	9.0	74.0	
			FIGURE LAKE	31	-	31	
			FORT SASKATCHEWAN	120	26.4	146.4	
			GLEN PARK	15	0.6	15.6	
			HAMELIN CREEK	43	0.8	43.8	
			HERCULES	19	-	19	
			MAJEAU LAKE	12	-	12	
			MILLET	15	-	15	
			NEW NORWAY	9	-	9	
			OKOTOKS	135	0.1	135.1	
			ST. ALBERT	16	22.5	38.5	
			TANGENT	165	-	165	
			TURIN (BOW ISLAND, BLAIRMORE, ELLIS)	26	-	26	
			VIKING-KINSELLA (BLAIRMORE, DEVONIAN)	18	3.2	21.2	
			WATTS	1.9	0.5	2.4	

TABLE B - 1 (CONT)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
YEAR	WILDCAT WELLS PER YEAR	WILDCAT WELLS CUMULATIVE	NAME OF GAS RESERVES DISCOVERED	REMAINING DISPOSABLE GAS RESERVES AS OF SEPTEMBER 30, 1959 BCF	CUMULATIVE GAS MARKETED TO JUNE 30, 1959 BCF	INITIAL DISPOSABLE GAS RESERVES BCF	CUMULATIVE INITIAL DISPOSABLE GAS RESERVES BCF
1951 (CONT)			WESTLOCK (BLAIRMORE)	2	-	2	
			WIMBORNE (NISKU ASSOCIATED)	2	-	2	
			WIZARD LAKE	99	6.2	105.2	
			OTHER SMALL RESERVES	53	-	53	11864
1952	469	2127	ALIX (BASAL BLAIRMORE)	10	-	10	
			BELLOY (CADOTTE, GETHING)	54	-	54	
			BIG LAKE	30	-	30	
			BINDLOSS (VIKING)	270	8.0	278.0	
			BITTERN LAKE	26	-	26	
			CHIGWELL	60	-	60	
			COLD LAKE	2.0	1.3	3.3	
			COMREY	45	2.7	47.7	
			DIXONVILLE	27	-	27	
			DUVERNAY	0.1	1.5	1.6	
			EAGLESHAM (MISSISSIPPIAN)	90	-	90	
			ERSKINE	46	0.3	46.3	
			GHOST PINE	14	-	14	
			GORDONDALE (CADOTTE)	70	4.6	74.6	
			HACKETT	30	-	30	
			HAIRY HILL	13	2.9	15.9	
			HAMILTON LAKE	40	-	40	
			HUSSAR (BLAIRMORE)	300	-	300	
			MALMO	17	-	17	
			MINNEHIK-BUCK LAKE	204	-	204	
			NEVIS	580	-	580	
			OLDS	120	-	120	
			PHIL CAN	13	-	13	
			PIGEON LAKE	10	-	10	
			RYCROFT	11	2.0	13.0	
			ST. BRIDES	20	-	20	
			STURGEON LAKE	16	-	16	
			STURGEON LAKE SOUTH - GENERAL AREA	57	-	57	
			WEST DRUMHELLER	28	-	28	
			WESTEROSE	155	-	155	
			WILDUNN CREEK	15	-	15	
			OTHER SMALL RESERVES	87	-	87	14348
1953	399	2526	ATLEE-BUFFALO (BASAL BLAIRMORE)	55	0.4	55.4	
			DONALDA	14	-	14	
			DYBERG	14	-	14	
			ENCHANT	29	-	29	
			GILBY	328	-	328	
			GORDONDALE (NOTIKEWIN, GETHING)	68	9.8	77.8	
			HOMEGLEN-RIMBEY	713	-	713	
			JOFFRE (VIKING SOLUTION)	9	-	9	

TABLE B -1 (CONT)

(1) YEAR	(2) WILDCAT WELLS PER YEAR	(3) WILDCAT WELLS CUMULATIVE	(4) NAME OF GAS RESERVES DISCOVERED	(5) REMAINING DISPOSABLE GAS RESERVES AS OF SEPTEMBER 30, 1959 BCF	(6) CUMULATIVE GAS MARKETED TO JUNE 30, 1959 BCF	(7) INITIAL DISPOSABLE GAS RESERVES BCF	(8) CUMULATIVE INITIAL DISPOSABLE GAS RESERVES BCF
1953 (CONT)			KESSLER	40	-	40	
			PARKLAND	20	-	20	
			PEMBINA	407	16.0	423.0	
			POUCE COUPE SOUTH (PEACE RIVER, CADOMIN, TRIASSIC)	202	22.6	224.6	
			SAMSON	10	1.3	11.3	
			STURGEON LAKE SOUTH	136	1.0	137.0	
			SYLVAN LAKE	114	-	114	
			THREE HILLS CREEK	163	-	163	
			USONA	10	-	10	
			WATERGLEN	12	-	12	
			WAYNE-ROSEDALE	135	0.9	135.9	
			WESTEROSE SOUTH	1150	-	1150	
			WOOD RIVER	40	-	40	
			OTHER SMALL RESERVES	106	-	106	18175
1954	351	2877	ALEXANDER	48	21.4	69.4	
			ALHAMBRA	25	-	25	
			BELLSHILL LAKE	56	-	56	
			BINDLOSS (BASAL BLAIRMORE)	35	-	35	
			BRAEBURN	86	-	86	
			CALGARY (WABAMUN)	600	-	600	
			CAROLINE	15	-	15	
			GARRINGTON (CARDIUM SOLUTION, LEDUC)	35	-	35	
			GRASSY ISLAND LAKE	23	-	23	
			HARMATTAN-ELKTON (MISSISSIPPIAN ASSOCIATED)	900	-	900	
			HOLBORNE	24	-	24	
			HUSSAR (VIKING)	25	-	25	
			SADDLE HILLS	57	-	57	
			SARCEE	130	-	130	
			SAVANNA CREEK	550	-	550	
			WESTWARD HO (MISSISSIPPIAN NON-ASSOCIATED)	30	-	30	
			WIMBORNE (VIKING, LEDUC ASSOCIATED & SOLUTION)	269	-	269	
			OTHER SMALL RESERVES	34	-	34	21138
1955	346	3223	BURNT RIVER	10	-	10	
			CARBON	113	0.1	113.1	
			CONTROL	20	-	20	
			ETZIKOM (BASAL BLAIRMORE)	1	-	1	
			HARMATTAN-ELKTON (MISSISSIPPIAN SOLUTION)	100	-	100	
			HUSSAR (BASAL COLORADO)	150	-	150	
			LONE PINE CREEK (WABAMUN)	100	-	100	
			ROLLING HILLS (BASAL COLORADO)	6	-	6	
			SUNDRE (MISSISSIPPIAN ASSOCIATED & SOLUTION)	42	-	42	
			WESTWARD HO (MISSISSIPPIAN SOLUTION)	17	-	17	
			WINDFALL	330	-	330	
			OTHER SMALL RESERVES	92	-	92	22119

TABLE B - 1 (CONT)

(1) YEAR	(2) WILDCAT WELLS PER YEAR	(3) WILDCAT WELLS CUMULATIVE	(4) NAME OF GAS RESERVES DISCOVERED	(5) REMAINING DISPOSABLE GAS RESERVES AS OF SEPTEMBER 30, 1959 BCF	(6) CUMULATIVE GAS MARKETED TO JUNE 30, 1959 BCF	(7) INITIAL DISPOSABLE GAS RESERVES BCF	(8) CUMULATIVE INITIAL DISPOSABLE GAS RESERVES BCF
1956	384	3607	ALIX (NISKU)	3	-	3	
			BEAVER CREEK	90	-	90	
			BEAVERHILL LAKE (BASAL BLAIRMORE)	3	-	3	
			BELLOY (NOTIKEWIN)	7	-	7	
			CARSTAIRS (BASAL BLAIRMORE)	12	-	12	
			CHINOOK RIDGE	45	-	45	
			CONNORSVILLE	18	-	18	
			CROSSFIELD	300	-	300	
			EAGLESHAM (GETHING, CADOMIN)	8	-	8	
			GOODWIN LAKE	28	-	28	
			HARMATTAN EAST	280	-	280	
			INNISFAIL	98	-	98	
			KEVISVILLE	10	-	10	
			KEYSTONE (BASAL BELLY RIVER, CARDIUM SOLUTION)	85	-	85	
			LEAFLAND	17	-	17	
			MAZEPPA	15	-	15	
			MOUNTAIN PARK	25	-	25	
			NORMANDVILLE (TRIASSIC, MISSISSIPPIAN)	23	0.1	23.1	
			OBED	10	-	10	
			PADDLE RIVER	28	-	28	
			POUCE COUPE SOUTH (JURASSIC)	3	-	3	
			ROSEBUD	10	-	10	
			TWO CREEK	10	-	10	
			WARBURG	12	-	12	
			WATERTON (MISSISSIPPIAN)	750	-	750	
			WEST PRAIRIE	20	-	20	
			OTHER SMALL RESERVES	100	-	100	24129
1957	428	4035	ANTELOPE	12	-	12	
			BLUERIDGE	13	-	13	
			CALGARY (BASAL BLAIRMORE, MISSISSIPPIAN)	530	-	530	
			CARSON CREEK	40	-	40	
			CHISHOLM	10	-	10	
			FAUST SOUTH	10	-	10	
			GARRINGTON (VIKING)	15	-	15	
			HARMATTAN-ELKTON (MISSISSIPPIAN NON-ASSOCIATED)	35	-	35	
			JOFFRE (BASAL BLAIRMORE, NISKU SOLUTION)	65	-	65	
			KAYBOB	213	-	213	
			KEYSTONE (BLAIRMORE, NORDEGG)	8	-	8	
			LOBSTICK	50	-	50	
			LOVETT	80	-	80	
			PINE CREEK	500	-	500	
			POUCE COUPE SOUTH (GETHING)	12	-	12	
			STOLBERG	70	-	70	
			SUNDRE (VIKING, BASAL BLAIRMORE)	35	-	35	
			SWAN HILLS	350	-	350	
			VIRGINIA HILLS	12	-	12	
			OTHER SMALL RESERVES	143	-	143	26332

TABLE B - 1 (CONT)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
YEAR	WILDCAT WELLS PER YEAR	WILDCAT WELLS CUMULATIVE	NAME OF GAS RESERVES DISCOVERED	REMAINING DISPOSABLE GAS RESERVES AS OF SEPTEMBER 30, 1959 BCF	CUMULATIVE GAS MARKETED TO JUNE 30, 1959 BCF	INITIAL DISPOSABLE GAS RESERVES BCF	CUMULATIVE INITIAL DISPOSABLE GAS RESERVES BCF
1958	404	4439	BERLAND RIVER	300	-	300	
			BERLAND RIVER WEST	15	-	15	
			CARSON CREEK NORTH	40	-	40	
			CARSTAIRS (MISSISSIPPIAN)	750	-	750	
			FOX CREEK WEST (NISKU)	13	-	13	
			LONE PINE CREEK (BASAL BLAIRMORE)	3	-	3	
			PENHOLD	12	-	12	
			PREVO	40	-	40	
			WATERTON (DEVONIAN)	200	-	200	
			WILDCAT HILLS	250	-	250	
			OTHER SMALL RESERVES	96	-	96	28051
1959	315	4754	BRAZEAU RIVER	20	-	20	
			BURNT TIMBER	120	-	120	
			CLEAR HILLS	11	-	11	
			FOX CREEK WEST (GETHING)	4	-	4	
			JUDY CREEK	34	-	34	
			LOOKOUT BUTTE	90	-	90	
			MEDICINE RIVER	11	-	11	
			SUNDRE (MISSISSIPPIAN NON-ASSOCIATED)	10	-	10	
			WORSLEY	45	-	45	
			OTHER SMALL RESERVES	71	-	71	28467

TABLE B - 2

OIL AND GAS CONSERVATION BOARD

TRENDS IN WILDCAT DRILLING AND IN THE DISCOVERY OF INITIAL DISPOSABLE RESERVES

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	WILDCAT WELLS DRILLED		REMAINING DISPOSABLE RESERVES AS OF SEPTEMBER 30, 1959	CUMULATIVE SALES OF MARKETABLE GAS TO JUNE 30, 1959	INITIAL RESERVES BY YEAR OF DISCOVERY	CUMULATIVE INITIAL DISPOSABLE RESERVES	INITIAL DISPOSABLE RESERVES PER WILDCAT WELL	
YEAR	ANNUAL	CUMULATIVE	BCF	BCF	BCF	BCF	ANNUAL BASIS BCF	CUMULATIVE BASIS BCF
PRIOR TO 1945		457	3291.7	1133.5	4425.2	4425.2		
1945	56	513	4	-	4	4429.2	0.1	8.6
1946	54	567	815.7	76.3	892.0	5321.2	16.5	9.4
1947	71	638	730.3	120.4	850.7	6171.9	12.0	9.7
1948	126	764	1616.8	42.2	1659.0	7830.9	13.2	10.2
1949	209	973	2013.6	21.1	2034.7	9865.6	9.7	10.1
1950	224	1197	382.7	8.2	390.9	10256.5	1.7	8.6
1951	461	1658	1519.9	87.9	1607.8	11864.3	3.5	7.2
1952	469	2127	2460.1	23.3	2483.4	14347.7	5.3	6.7
1953	399	2526	3775	52.0	3827.0	18147.7	9.6	7.2
1954	351	2877	2942	21.4	2963.4	21138.1	8.5	7.3
1955	346	3223	981	0.1	981.1	22119.2	2.8	6.9
1956	384	3607	2010	0.1	2010.1	24129.3	5.3	6.7
1957	428	4035	2203	-	2203	26332.3	5.1	6.5
1958	404	4439	1719	-	1719	28051.3	4.3	6.3
JANUARY TO SEPTEMBER, 1959	315	4754	416	-	416	28467.3	1.3	6.0

TABLE B - 3

OIL AND GAS CONSERVATION BOARD

APPRECIATION OF INITIAL DISPOSABLE RESERVES BY YEAR OF DISCOVERY

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			RESERVES AS ESTIMATED IN PUBLISHED BOARD REPORTS				
YEAR DISCOVERED	DECEMBER 31, 1951 BCF	JUNE 30, 1953 BCF	JUNE 30, 1955 BCF	SEPTEMBER 30, 1956 BCF	MARCH 31, 1958 BCF	DECEMBER 31, 1958 BCF	SEPTEMBER 30, 1959 BCF
1951	215 (1)	1506	1563	1600	1718	1663	1608
1952		1002	1359	1610	2201	2101	2483
1953		618(JUNE)(2)	2538	2927	3338	3804	3827
1954			835	1776	2590	2665	2963
1955		142(JUNE)(2)	1101	908	1094	981	
1956			464(SEPT.)(2)	1601	2045	2010	
1957				1382	1586	2203	
1958				135(MARCH)(2)	1228	1719	

(1) DID NOT INCLUDE SEVERAL DISCOVERIES IN THE LATTER PART OF 1951.

(2) RESERVE FIGURE FOR THE PARTIAL YEAR.

TABLE B - 4

OIL AND GAS CONSERVATION BOARD

PERCENTAGE APPRECIATION OF RESERVES SUBSEQUENT TO ESTIMATES ONE YEAR FROM DATE OF DISCOVERY

(1)	(2)		(3)		(4)		(5)		(6)		(7)		(8)	
	YEARS FROM AVERAGE DATE OF DISCOVERY													
	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
YEAR DISCOVERED	BCF (1)	PER CENT	BCF	PER CENT	BCF	PER CENT	BCF	PER CENT	BCF	PER CENT	BCF	PER CENT	BCF	PER CENT
1951	670	100	1510	225	1540	230	1560	233	1590	237	1660	248	1700	254
1952	1000	100	1180	118	1360	136	1560	156	1900	190	2170	217	2360	236
1953	1630	100	2540	156	2840	174	3130	192	3490	214	3810	234		
1954	840	100	1580	188	2180	259	2610	310	2850	339				
1955	840	100	1010	120	970	115	1020	122						
1956	1040	100	1750	168	2020	194								
1957	1440	100	1990	138										
1958	1560	100												

(1) RESERVES FROM FIGURE B-3

TABLE B - 5

OIL AND GAS CONSERVATION BOARD

ANTICIPATED APPRECIATION OF KNOWN RESERVES AND CORRESPONDING ADJUSTED DISCOVERIES PER WILDCAT WELL

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
YEAR DISCOVERED	RESERVES AS OF SEPT. 30, 1959 BCF	AVERAGE DISCOVERY DATE TO SEPT. 30, 1959 YEARS	RESERVE APPRECIATION RATIO(1)		ULTIMATE RESERVES BCF		CUMULATIVE ULTIMATE RESERVES BCF		CUMULATIVE WILDCAT WELLS	ADJUSTED INITIAL DISPOSABLE RESERVES PER WILDCAT WELL			
										ANNUAL		CUMULATIVE	
			NORMAL	LOW	NORMAL	LOW	NORMAL	LOW		NORMAL	LOW	NORMAL	LOW
PRIOR TO 1952	11,865				11,870	11,870	11,870	11,870	1,658			7.2	7.2
1952	2,483	7.25	1.00	1.00	2,500	2,500	14,370	14,370	2,127	5.3	5.3	6.8	6.8
1953	3,827	6.25	1.03	1.01	3,940	3,870	18,310	18,240	2,526	9.9	9.7	7.3	7.2
1954	2,963	5.25	1.09	1.04	3,220	3,080	21,530	21,320	2,877	9.2	8.8	7.5	7.4
1955	981	4.25	1.17	1.11	1,140	1,090	22,670	22,410	3,223	3.3	3.2	7.1	7.0
1956	2,010	3.25	1.31	1.22	2,630	2,450	25,300	24,860	3,607	6.9	6.4	7.0	6.9
1957	2,203	2.25	1.56	1.43	3,400	3,140	28,700	28,000	4,035	7.9	7.3	7.1	6.9
1958	1,719	1.25	2.22	1.92	3,800	3,300	32,500	31,300	4,439	9.4	8.2	7.3	7.1
JAN. TO SEPT. 1959	416	0.38	4.3	3.8	1,800	1,600	34,300	32,900	4,754	5.7	5.1	7.2	6.9

(1) FIGURE B - 5.

TABLE B - 6

OIL AND GAS CONSERVATION BOARD

FORECAST OF ANTICIPATED ADDITIONAL RESERVES (FUTURE APPRECIATION OF KNOWN RESERVES PLUS NEW DISCOVERIES)

BASIS: NORMAL RESERVE APPRECIATION; 400 WILDCAT WELLS PER YEAR

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
					INITIAL DISPOSABLE RESERVES AS OF						
YEAR DISCOVERED	SEPT. 30, 1959	DEC. 31, 1960	DEC. 31, 1961	DEC. 31, 1962	DEC. 31, 1963	DEC. 31 1964	DEC. 31, 1965	DEC. 31, 1966	DEC. 31, 1967	DEC. 31, 1968	DEC. 31, 1969
PRIOR TO 1952	11,865	11,870	11,870	11,870	11,870	11,870	11,870	11,870	11,870	11,870	11,870
1952	2,483	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
1953	3,827	3,940	3,940	3,940	3,940	3,940	3,940	3,940	3,940	3,940	3,940
1954	2,963	3,140	3,220	3,220	3,220	3,220	3,220	3,220	3,220	3,220	3,220
1955	981	1,060	1,120	1,140	1,140	1,140	1,140	1,140	1,140	1,140	1,140
1956	2,010	2,290	2,450	2,580	2,630	2,630	2,630	2,630	2,630	2,630	2,630
1957	2,203	2,680	2,950	3,160	3,340	3,400	3,400	3,400	3,400	3,400	3,400
1958	1,719	2,560	2,990	3,300	3,540	3,720	3,800	3,800	3,800	3,800	3,800
1959	416	1,010	1,350	1,570	1,740	1,860	1,960	2,000	2,000	2,000	2,000
TOTAL KNOWN RESERVES	28,467	31,050	32,390	33,280	33,920	34,280	34,460	34,500	34,500	34,500	34,500
CUMULATIVE APPRECIATION OF KNOWN RESERVES	-	2,580	3,920	4,810	5,450	5,810	5,990	6,030	6,030	6,030	6,030
1960	-	640	1,350	1,800	2,100	2,320	2,490	2,620	2,670	2,670	2,670
1961	-	-	630	1,320	1,770	2,060	2,280	2,450	2,570	2,620	2,620
1962			-	620	1,310	1,750	2,040	2,260	2,430	2,550	2,600
1963				-	620	1,310	1,750	2,040	2,250	2,420	2,540
1964					-	620	1,310	1,750	2,040	2,250	2,420
1965						-	610	1,300	1,740	2,030	2,240
1966							-	600	1,260	1,690	1,970
1967								-	570	1,210	1,610
1968									-	540	1,130
1969										-	500
TOTAL RESERVES IN NEW DISCOVERIES	-	640	1,980	3,740	5,800	8,060	10,480	13,020	15,530	17,980	20,300
CUMULATIVE NEW DISCOVERIES	-	640	1,270	1,890	2,510	3,130	3,740	4,340	4,910	5,450	5,950
CUMULATIVE APPRECIATION OF NEW DISCOVERIES	-	-	710	1,850	3,290	4,930	6,740	8,680	10,620	12,530	14,350
TOTAL ADDITIONAL RESERVES	-	3,220	5,900	8,550	11,250	13,870	16,470	19,050	21,560	24,010	26,330

TABLE B - 7

OIL AND GAS CONSERVATION BOARD

FORECAST OF ANTICIPATED ADDITIONAL RESERVES (FUTURE APPRECIATION OF KNOWN RESERVES PLUS NEW DISCOVERIES)

BASIS: LOW RESERVE APPRECIATION, 300 WILDCAT WELLS PER YEAR

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
					INITIAL DISPOSABLE RESERVES AS OF						
YEAR DISCOVERED	SEPT. 30, 1959	DEC. 31, 1960	DEC. 31, 1961	DEC. 31, 1962	DEC. 31, 1963	DEC. 31, 1964	DEC. 31, 1965	DEC. 31, 1966	DEC. 31, 1967	DEC. 31, 1968	DEC. 31, 1969
PRIOR TO 1952	11,865	11,870	11,870	11,870	11,870	11,870	11,870	11,870	11,870	11,870	11,870
1952	2,483	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
1953	3,827	3,870	3,870	3,870	3,870	3,870	3,870	3,870	3,870	3,870	3,870
1954	2,963	3,040	3,080	3,080	3,080	3,080	3,080	3,080	3,080	3,080	3,080
1955	981	1,050	1,080	1,090	1,090	1,090	1,090	1,090	1,090	1,090	1,090
1956	2,010	2,240	2,370	2,420	2,450	2,450	2,450	2,450	2,450	2,450	2,450
1957	2,203	2,640	2,880	3,030	3,110	3,140	3,140	3,140	3,140	3,140	3,140
1958	1,719	2,400	2,770	3,020	3,180	3,260	3,300	3,300	3,300	3,300	3,300
1959	416	1,040	1,310	1,510	1,650	1,740	1,780	1,800	1,800	1,800	1,800
TOTAL KNOWN RESERVES	28,467	30,650	31,730	32,390	32,800	33,000	33,080	33,100	33,100	33,100	33,100
CUMULATIVE APPRECIATION OF KNOWN RESERVES	-	2,180	3,260	3,920	4,330	4,530	4,610	4,630	4,630	4,630	4,630
1960	-	620	1,270	1,600	1,850	2,020	2,120	2,180	2,200	2,200	2,200
1961		-	550	1,120	1,410	1,630	1,780	1,870	1,920	1,940	1,940
1962			-	540	1,090	1,380	1,590	1,730	1,830	1,870	1,890
1963				-	530	1,080	1,360	1,570	1,710	1,810	1,850
1964					-	530	1,070	1,360	1,560	1,700	1,800
1965						-	530	1,070	1,350	1,550	1,690
1966							-	520	1,060	1,340	1,540
1967								-	520	1,050	1,330
1968									-	490	1,000
1969										-	460
TOTAL RESERVES IN NEW DISCOVERIES	-	620	1,820	3,260	4,880	6,640	8,450	10,300	12,150	13,950	15,700
CUMULATIVE NEW DISCOVERIES	-	620	1,170	1,710	2,240	2,770	3,300	3,820	4,340	4,830	5,290
CUMULATIVE APPRECIATION OF NEW DISCOVERIES		-	650	1,550	2,640	3,870	5,150	6,480	7,810	9,120	10,410
TOTAL ADDITIONAL RESERVES	-	2,800	5,080	7,180	9,210	11,170	13,060	14,930	16,780	18,580	20,330

FIGURE B-1

GROWTH OF
CUMULATIVE INITIAL DISPOSABLE RESERVES
OF NATURAL GAS BY YEAR OF DISCOVERY

PROVINCE OF ALBERTA

OIL AND GAS CONSERVATION BOARD

DECEMBER 1959

SEPTEMBER 30, 1959 ESTIMATE
REPORT OF DECEMBER, 1959

DECEMBER 31, 1958 ESTIMATE
REPORT OF MARCH, 1959

MARCH 31, 1958 ESTIMATE
REPORT OF SEPTEMBER, 1958

OVERALL INCREASE AT 2.9 TRILLION CUBIC FEET PER YEAR

SEPTEMBER 30, 1956 ESTIMATE
REPORT OF JANUARY, 1957

PROXIMITY OF LINES
PREVENTS INDIVIDUAL
PLOTTING

JUNE 30, 1955 ESTIMATE
REPORT OF NOVEMBER, 1955

JUNE 30, 1953 ESTIMATE
REPORT OF NOVEMBER, 1953

DECEMBER 31, 1951 ESTIMATE
REPORT OF MARCH, 1952

CUMULATIVE INITIAL DISPOSABLE RESERVES — TRILLIONS OF CUBIC FEET

0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

1940 1942 1944 1946 1948 1950 1952 1954 1956 1958 1960

YEAR OF DISCOVERY

FIGURE B-2

TRENDS IN THE DISCOVERY OF NATURAL GAS RESERVES PER WILDCAT WELL DRILLED

PROVINCE OF ALBERTA

OIL AND GAS CONSERVATION BOARD

DECEMBER 1959

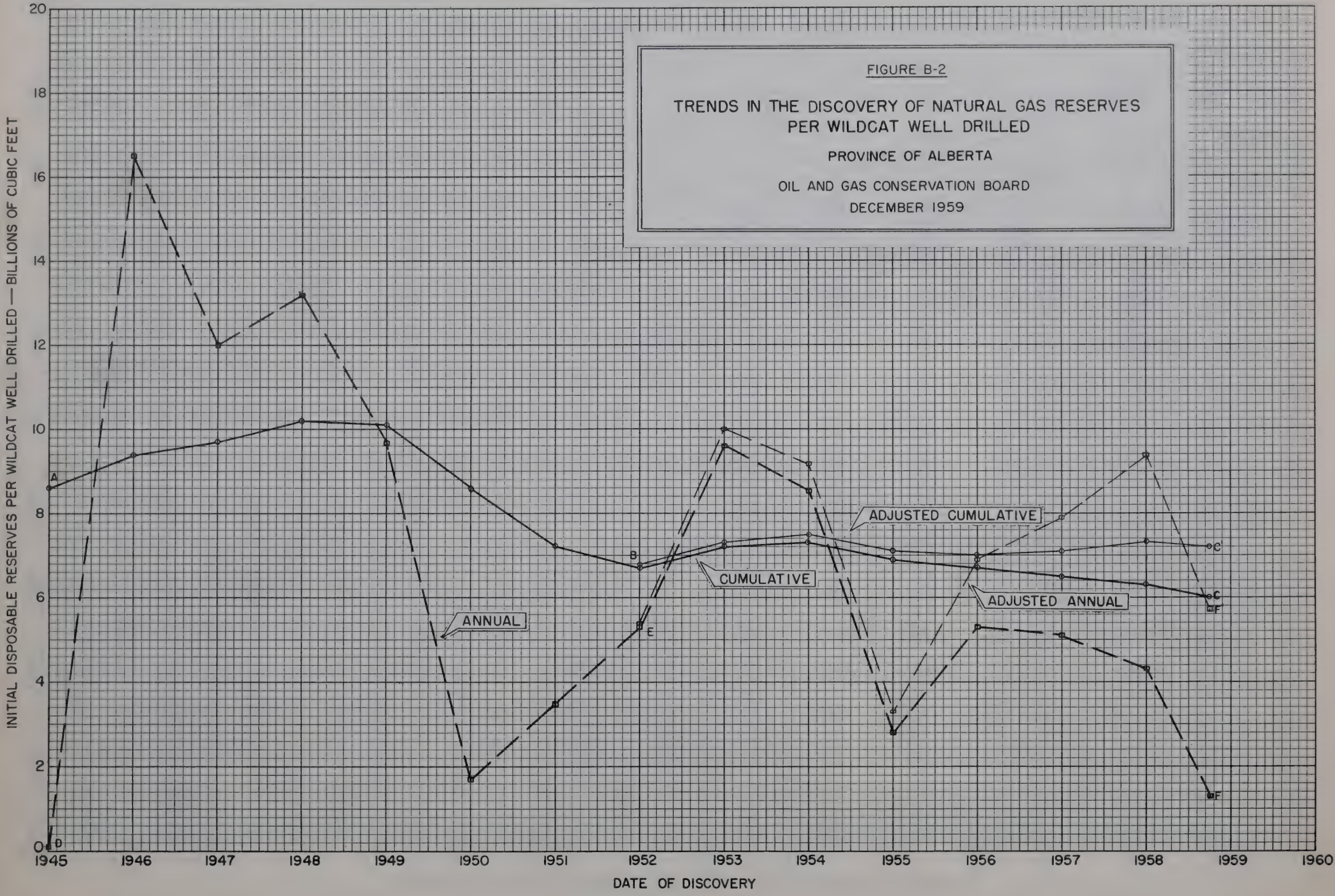


FIGURE B-3

APPRECIATION OF RESERVES BY YEAR OF DISCOVERY

PROVINCE OF ALBERTA

OIL AND GAS CONSERVATION BOARD

DECEMBER 1959

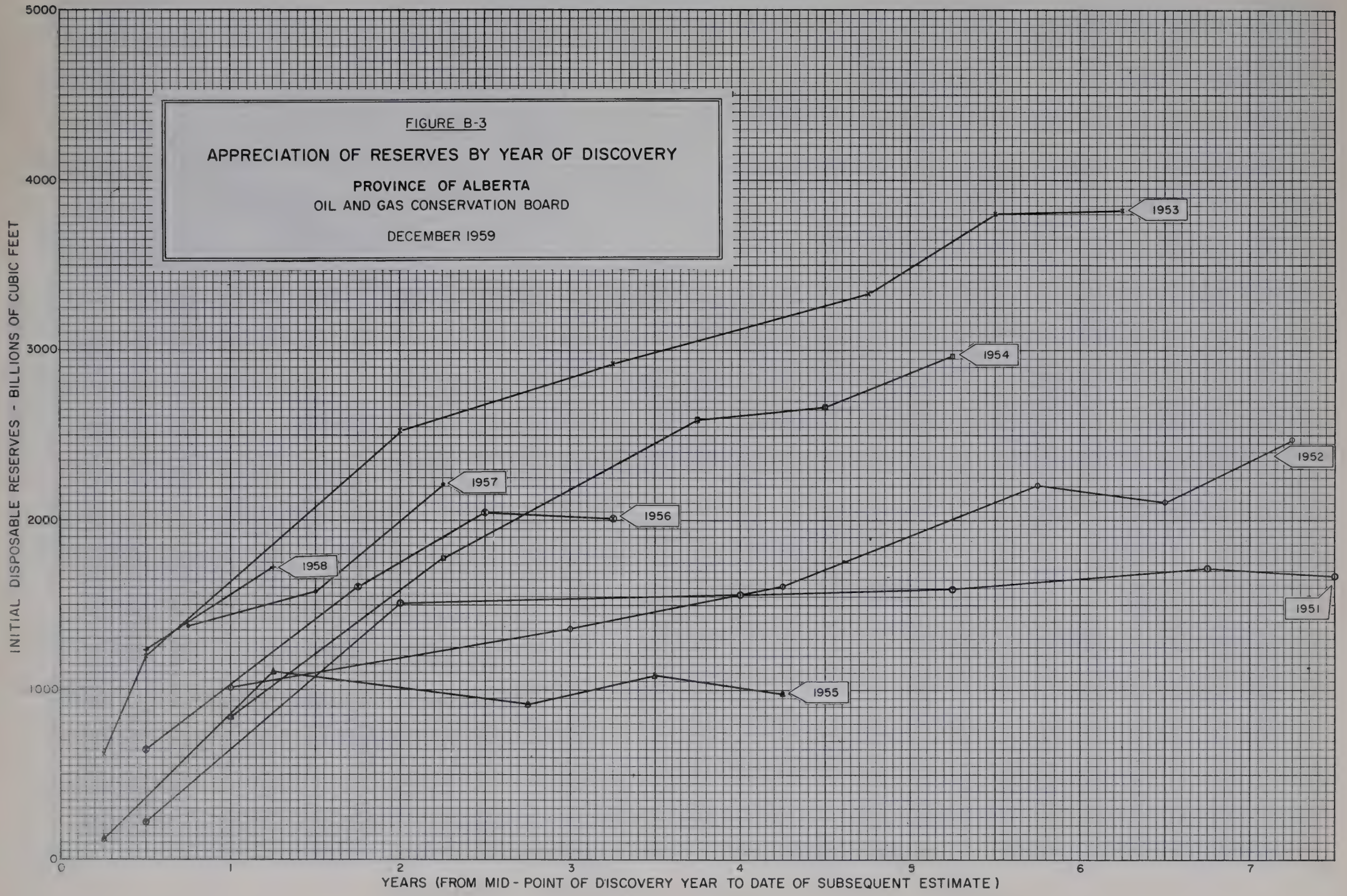


FIGURE B-4

PERCENTAGE APPRECIATION OF RESERVES BY YEAR OF DISCOVERY (BASIS: ESTIMATE OF RESERVES ONE YEAR FROM DATE OF DISCOVERY)

PROVINCE OF ALBERTA

OIL AND GAS CONSERVATION BOARD

DECEMBER 1959

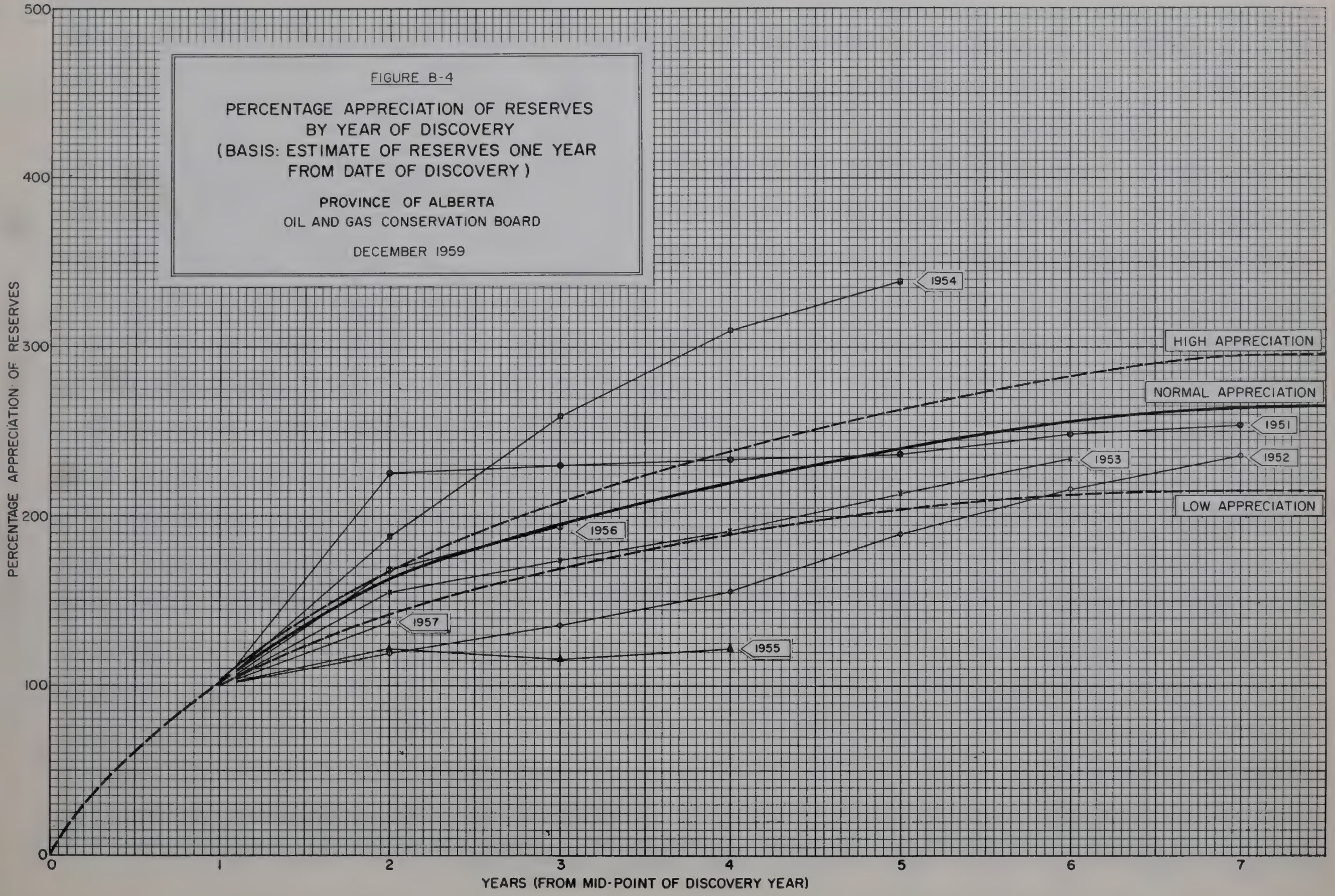


FIGURE B-5

RESERVE APPRECIATION RATIO VERSUS YEARS FROM DATE OF DISCOVERY

PROVINCE OF ALBERTA

OIL AND GAS CONSERVATION BOARD

DECEMBER 1959

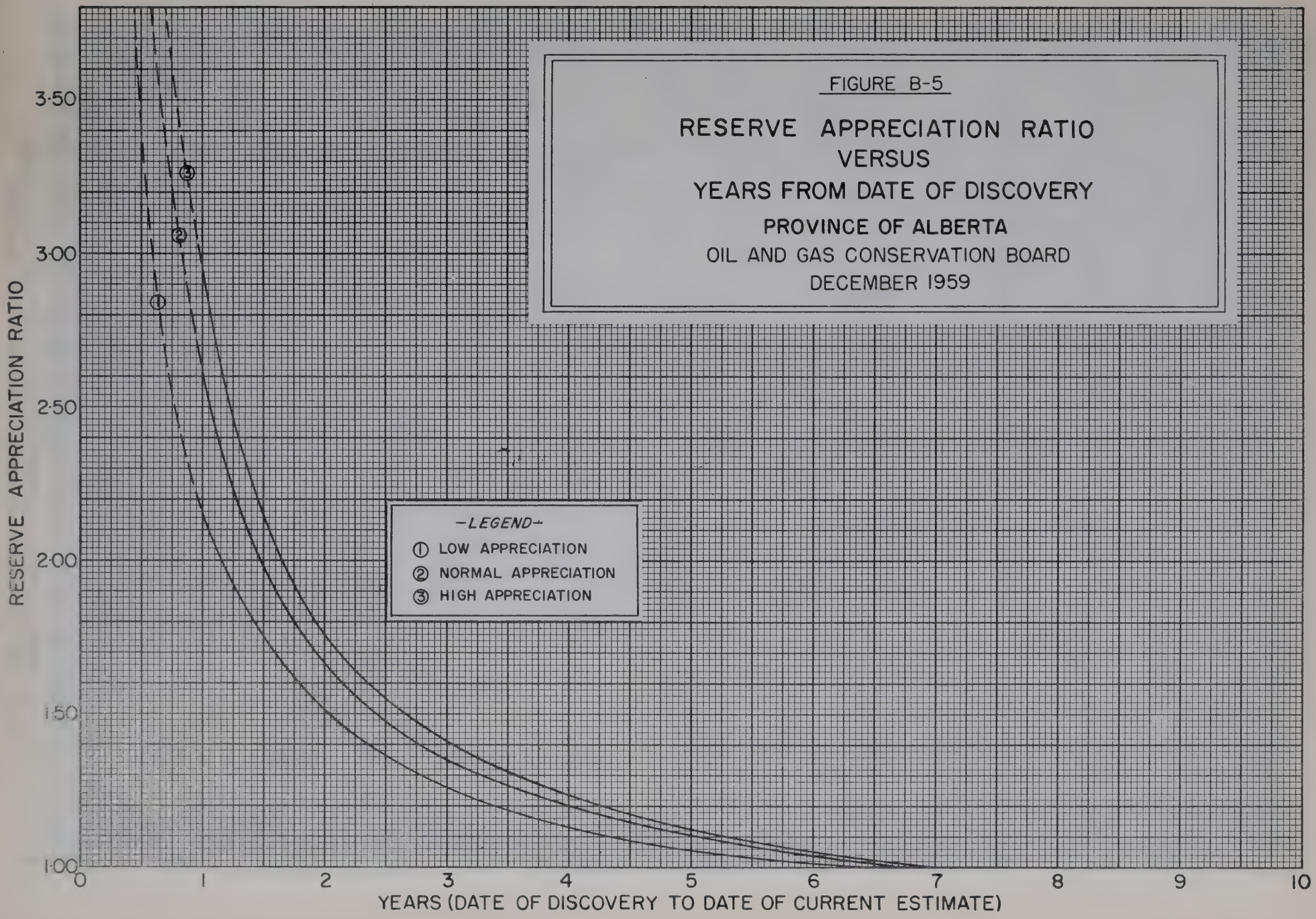


FIGURE B-6

TRENDS IN THE GROWTH OF INITIAL DISPOSABLE RESERVES OF NATURAL GAS

PROVINCE OF ALBERTA

OIL AND GAS CONSERVATION BOARD
DECEMBER 1959

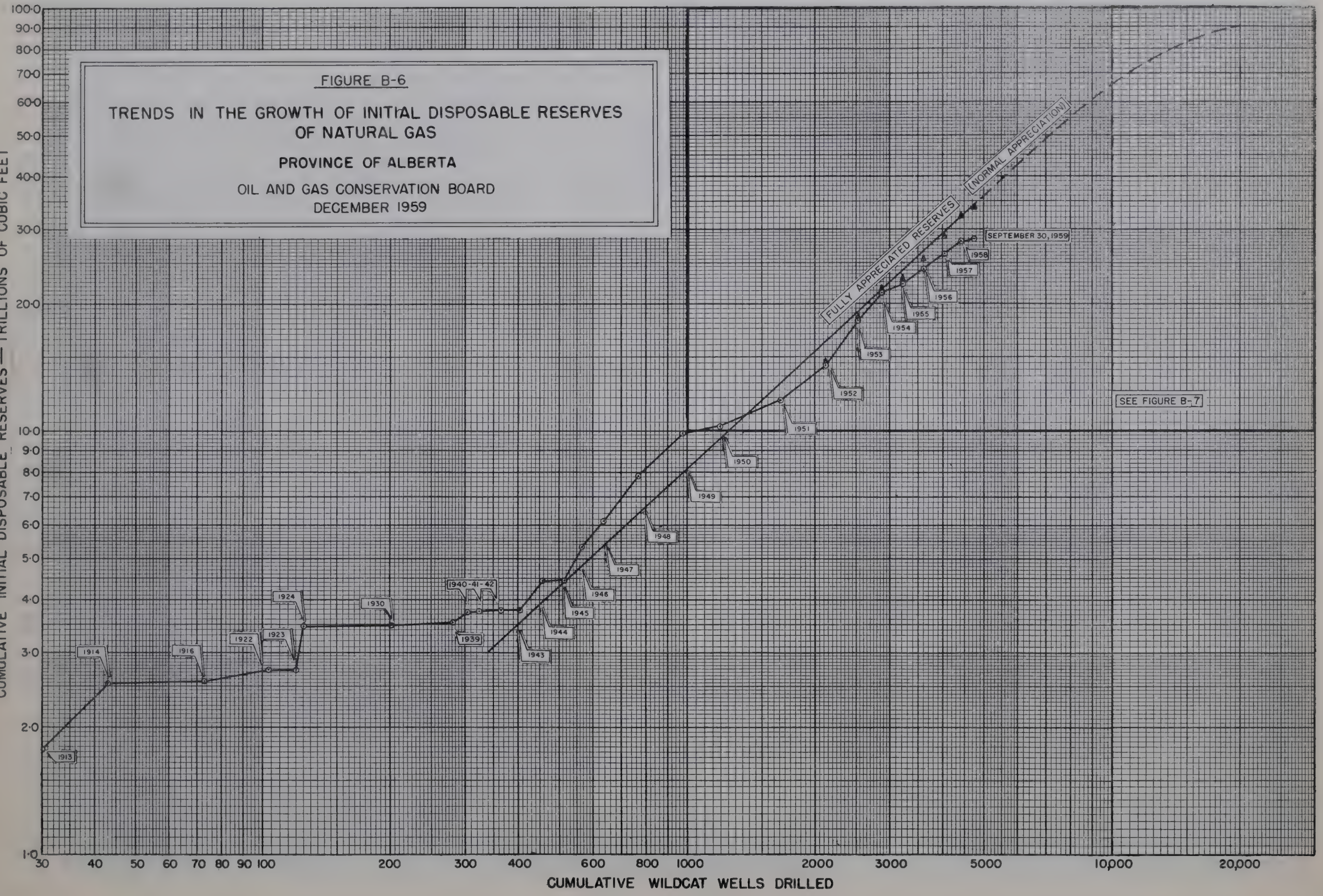


FIGURE B-7

TRENDS IN THE GROWTH OF INITIAL DISPOSABLE RESERVES OF NATURAL GAS

– EXPANSION OF FIGURE B-6 –

PROVINCE OF ALBERTA

OIL AND GAS CONSERVATION BOARD
DECEMBER 1959

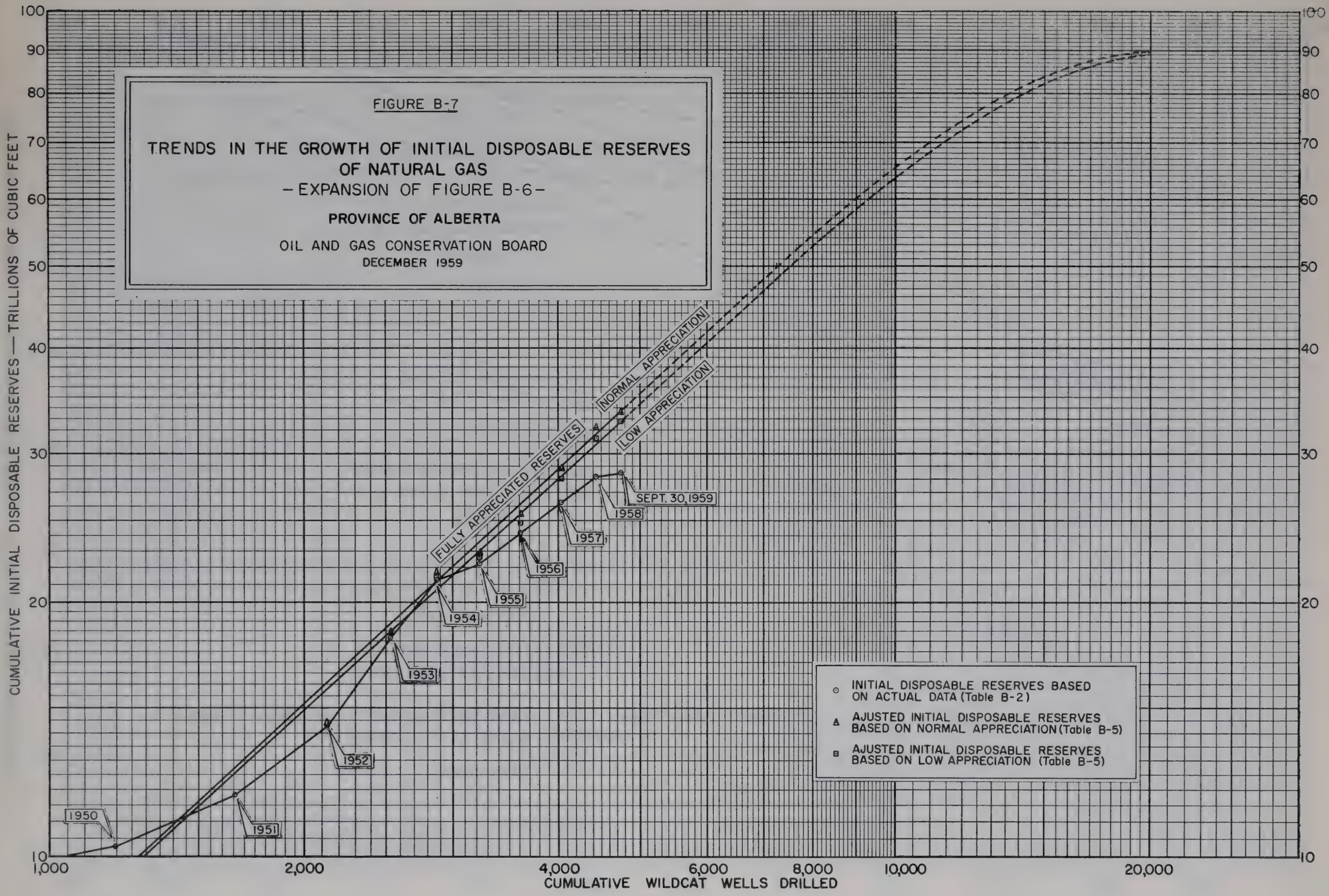


FIGURE B-8

ANTICIPATED FUTURE RESERVES
(APPRECIATION OF KNOWN RESERVES PLUS NEW DISCOVERIES)

PROVINCE OF ALBERTA

OIL AND GAS CONSERVATION BOARD

DECEMBER, 1959

BASIS

400 WILDCAT WELLS PER YEAR

NORMAL RESERVE APPRECIATION

CUMULATIVE INITIAL DISPOSABLE RESERVES — TRILLIONS OF CUBIC FEET

32
28
24
20
16
12
8
4
0

1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970

TOTAL FUTURE RESERVES

TOTAL RESERVES FROM NEW DISCOVERIES

APPRECIATION OF NEW DISCOVERIES

APPRECIATION OF KNOWN RESERVES

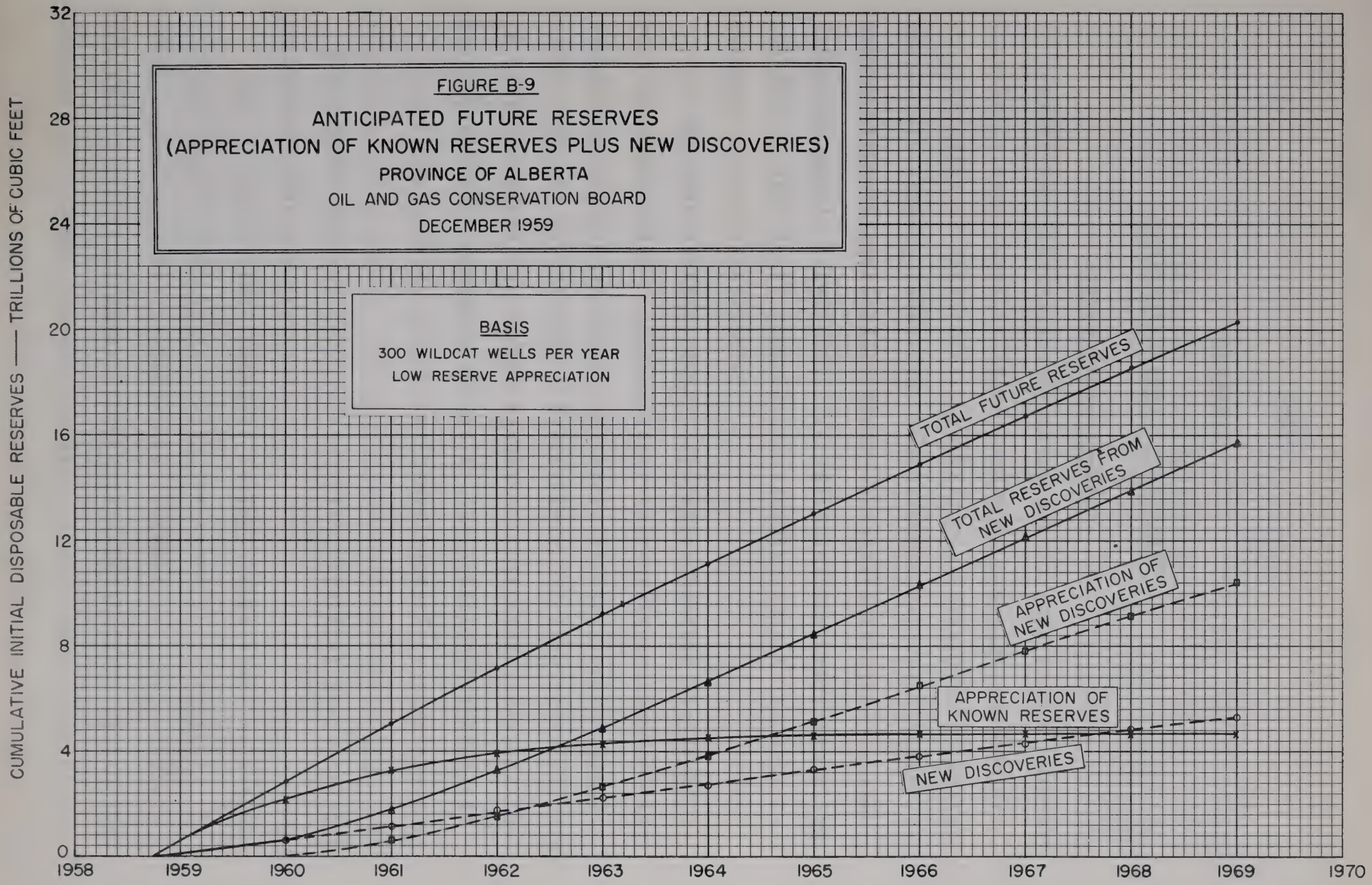
NEW DISCOVERIES

FIGURE B-9

ANTICIPATED FUTURE RESERVES
(APPRECIATION OF KNOWN RESERVES PLUS NEW DISCOVERIES)
PROVINCE OF ALBERTA
OIL AND GAS CONSERVATION BOARD
DECEMBER 1959

BASIS

300 WILDCAT WELLS PER YEAR
LOW RESERVE APPRECIATION



APPENDIX C

ALBERTA GAS REQUIREMENTS AND PRESENT EXPORT COMMITMENTS

Alberta Requirements

During the Alberta and Southern hearing the City of Calgary presented a comprehensive brief regarding gas requirements for the generation of electrical power for the Calgary Metropolitan area. Both Calgary Power Ltd. and Canadian Western Natural Gas Company Limited presented evidence on matters relating to the City of Calgary's submission. In addition, the Board consulted with the Alberta Power Commission regarding certain matters contained in the City's brief.

At the Saskatchewan Power Corporation hearing the Board received submissions regarding gas requirements in the Medicine Hat-Redcliff area from Dr. H. Harries, the Medicine Hat Chamber of Commerce and an individual businessman. Following the hearing the Board arranged for senior members of its staff to visit the major industrial consumers of gas in the Medicine Hat-Redcliff area in order to obtain first hand knowledge of future expansion plans.

The Board did not receive any briefs regarding the total gas requirements for the Province.

All of the evidence received during the October and November hearings was reviewed in detail by the Board and its staff. Having regard to this the Board has reviewed and revised its forecast of gas requirements for certain local areas within the Province. The Board has also revised its previous forecast of

total gas requirements for the Province by the advancement of the forecast period by one year.

Gas Requirements in the Calgary Metropolitan Area

City of Calgary Evidence on Power and Gas Requirements.

At the Alberta and Southern hearing, the City of Calgary, through its witnesses, Mr. S. J. Davies, Mr. A. A. Bishop and Mr. G. H. Cornish, requested "a reservation of a minimum of 1,130.84 billion cubic feet of natural gas for use in the production of additional electrical energy for the Calgary Metropolitan area over the thirty year period 1960-1989 inclusive". The submission made it clear that this requested volume was additional to any estimate which had hitherto been submitted to the Board.

In making this estimate the City had forecasted the total electrical power requirements of the Calgary Metropolitan area and had then given consideration to alternative methods of satisfying the requirements. It was concluded that existing contracts would be sufficient to meet requirements until 1965, but thereafter additional supplies would be needed. The City indicated that the best means of meeting these additional requirements would be by the construction of a local gas fired thermal power plant.

The City estimated that its annual electrical energy requirements would increase from 0.565 billion kilowatt hours in 1959 to 12.100 billion kilowatt hours in 1989. This is equivalent to per capita consumptions of 2,251 kilowatt hours in 1959 and 19,000 kilowatt hours in 1989. The City's estimate

of power requirements is thus premised upon an eight and a half fold increase in per capita consumption over the thirty year period. In terms of total electrical energy requirements, this increase represents an average growth of 10.5 per cent per year over the full period.

In its brief the City analyzed the relative costs of obtaining future electrical power from a coal fired plant at Wabamun as compared to a local gas fired power plant. The City assumed that 12.5 cubic feet of gas would be required to generate 1 kilowatt hour of electrical energy and that the gas would cost 20 cents per thousand cubic feet on an interruptible basis. Studies were made of the electrical energy transmission costs from Wabamun to Calgary. The City concluded that when the electrical power demand in the Calgary Metropolitan area exceeded the supply under contract with Calgary Power Ltd. it would be economic to construct a local gas fired power plant. The City indicated this plant would be required by approximately 1965 and that for the period 1965 to 1989 inclusive, 90.47 billion kilowatt hours would be generated. This electrical energy requirement is equivalent to 1,131.5 billion cubic feet of gas.

Canadian Western Natural Gas Company Evidence on Power and Gas Requirements.

Mr. B. W. Snyder, representing the Canadian Western Natural Gas Company Limited gave testimony regarding the estimates prepared by the City of Calgary. He indicated that in his opinion the City's forecast of electrical energy

requirements was too high. He presented Canadian Western's forecast based on a lower rate of growth equal to 7 per cent per year throughout the thirty year period. This estimate predicted a total electrical energy requirement of 61.54 billion kilowatt hours as compared to the City's 124.32 billion kilowatt hours. This is equivalent to a per capita consumption of 7,200 kilowatt hours in 1989.

Canadian Western also gave its estimate of the volumes of gas which would be required to generate a portion of this total electrical energy. Canadian Western assumed that additional contracts would not be signed by the City with Calgary Power Ltd. and that all requirements in excess of existing contracts would be supplied by a local gas fired power plant. The other basic assumptions made by the City were also accepted. Canadian Western estimated gas requirements equal to 362.5 billion cubic feet as compared to the City's 1,131.5 billion cubic feet. The substantial difference is due to the much smaller requirement of electrical energy forecasted by Canadian Western.

Calgary Power Ltd. Evidence on Power and Gas Requirements.

Mr. A. W. Howard, speaking for Calgary Power Ltd. noted that the City of Calgary brief provided for a very rapid rate of growth in per capita electrical energy requirements. The Company also made certain observations regarding the City's economic analysis of the relative cost of generating power at Wabamun as compared to a proposed local gas fired plant. In calculating transmission costs from Wabamun to Calgary the

City assumed the use of steel pole structures. Calgary Power pointed out that in its opinion wood pole structures would be satisfactory and much more economical. Reference was also made to the economies to be realized by the use of an integrated power grid system as compared to an operation based on a single transmission line as assumed by the City. Calgary Power also expressed doubt as to whether gas would be available at a price of 20 cents per thousand cubic feet over the life of the proposed plant.

The Alberta Power Commission Opinion on Power Requirements.

The Board consulted the Alberta Power Commission with regard to the estimates of future power requirements for the Calgary Metropolitan area and the feasibility of supplying a part of those requirements by a local gas fired plant. With regard to future power requirements, the Commission informed the Board that in its opinion an average annual rate of increase of 10 per cent over the next thirty years was too high. On the matter of future power supply sources, the Commission stated "We are rather doubtful that a plant operated in the vicinity of Calgary using natural gas at 20 cents per m.c.f. would be built". The doubt expressed by the Commission was predicated on the economies inherent in an integrated power grid system with respect to transmission costs, the relatively high operating costs of such a plant including incremental fuel costs, the high carrying charges of a large plant that possibly could not be loaded to optimum capacity for some

considerable time and the trend for base load power to be generated by thermal plants using strip mined coal rather than gas.

Analysis of Evidence on Power and Gas Requirements.

The Board has considered all of the evidence submitted regarding power requirements for the Calgary Metropolitan area, and in addition has examined the trends in growth rates for various parts of Canada. Reference has also been made to the forecast of power consumption contained in the report of the Gordon Royal Commission.

Based upon this information the Board has prepared its own forecast of power requirements on the same basis as it prepares forecasts for gas requirements. Increasing per capita consumption rates have been applied to the Board's projected population for the area. Although the per capita rates predicted are necessarily arbitrary the Board believes that a terminal rate approximately three and one half times the 1959 rate is realistic. The Board also believes that per capita rates will increase more rapidly during the early years of the forecast and has therefore allocated approximately 40 per cent of the total increase to the first ten years of a thirty year period.

The Board estimate of electrical energy requirements, together with estimates submitted by the City of Calgary and Canadian Western Natural Gas Company Limited for the Calgary Metropolitan area covering the period 1960-1989 is presented

in Table C-1. The Board estimate indicates a total requirement of 71.8 billion kilowatt hours as compared to 124.3 billion kilowatt hours estimated by the City of Calgary and 61.5 billion kilowatt hours estimated by the Canadian Western Natural Gas Company Limited.

Careful consideration has been given to the relative economics of developing power by a local gas fired plant as compared to transmitting power from a large coal fired plant at a location such as Wabamun. It is evident that the final decision will depend upon capital costs involved, power transmission costs and the relative fuel costs for each plant. The Board believes that it would be difficult for the City or a private firm to justify the investment in such a plant in view of the cost data advanced at the hearing, the existing contractual arrangements with Calgary Power Ltd. and the low load factor of the Calgary electrical distribution system. It would be particularly difficult to justify such an expenditure until the demand reached a level approximating the capacity of the minimum sized economic plant.

Nothwithstanding the above, the Board, in order to analyse the implications of such a development has prepared a forecast of gas requirements for power generation, using the City's basic assumptions and the Board's forecast of power demand. This estimate, presented in Table C-2, indicates a total of 38.12 billion kilowatt hours to be generated which would require 476.5 billion cubic feet of gas. In its brief the City assumed that such gas would be purchased on an interruptible

basis. This means that a portion of the total energy requirements referred to above would be generated by the alternative fuel supply utilized in such a plant. Gas requirements would therefore be something less than indicated in column 11 of Table C-2, and a discount factor of 10 per cent has been used. The Board therefore estimates that, assuming it were economic to construct a gas fired power plant in the Calgary Area, such a plant would require approximately 430 billion cubic feet of gas for the period 1960 to 1989. This may be compared to Canadian Western's estimate of 362 billion cubic feet and the City's estimate of 1,131 billion cubic feet.

Gas Requirements in the Medicine Hat-Redcliff Area

Dr. H. Harries' Evidence on Population and Gas Requirements.

At the hearing of the application of the Saskatchewan Power Corporation Dr. H. Harries presented a submission on the applicant's behalf outlining future population growth, industrial development and an estimate of requirements of gas for domestic, commercial and industrial purposes for the Medicine Hat-Redcliff area for the period January 1, 1959 to December 31, 1988. The forecast was based on estimates of annual per capita consumption for domestic, commercial and industrial purposes and estimates of population for the area.

In determining per capita consumption rates Dr. Harries made use of the data contained in previous Board reports. He predicted a combined domestic and commercial per capita rate

of 75 thousand cubic feet as compared to a per capita rate of 80 thousand cubic feet contained in the Board's 1958 report. Dr. Harries accepted the Board's 1958 industrial per capita rate of 300 thousand cubic feet in 1960 and an additional special allowance of 4 billion cubic feet per year for the requirements of the Calgary Power Plant.

The population forecast of Dr. Harries reflected the recent decline in growth rate and consequently was lower than the Board's forecast. The Board assumed the 1956 population to increase at an annual rate of 4 per cent until 1966 followed by a rate of 3 per cent for the next ten years and a rate of 2.5 per cent thereafter. Dr. Harries assumed an annual rate of increase of 3 per cent until 1961 followed by a constant annual rate of 2 per cent thereafter.

The estimate of total requirements submitted by Dr. Harries for the period 1959-1988 inclusive was 503 billion cubic feet of gas as compared to the Board's 1958 estimate of 566.8 billion cubic feet for the same period. Most of the difference in the estimates is due to the lower population growth predicted by Dr. Harries.

Evidence of Other Interested Parties.

The Medicine Hat Chamber of Commerce and Mr. G. H. Sissons of Medicine Hat Brick and Tile Company Limited presented briefs outlining the prospects for industrial expansion and the need for large reserves of low cost gas for this development.

Both parties made reference to the recently discovered large underground source of water suitable for industrial processes and suggested that this fact, together with adequate reserves of gas available at current prices had already attracted industry and would continue to do so in the future. Also it was stressed that since current plans for expansion by some local industries exceeded those indicated two years previously, all estimates of probable gas use should be generous.

Analysis of Evidence on Gas Requirements.

As previously indicated Dr. Harries' estimate of domestic and commercial requirements is quite similar to that prepared by the Board in the 1958 report. Dr. Harries has estimated total domestic and commercial requirements of 78.2 billion cubic feet for the period 1960-1989 inclusive as compared to the Board's estimate (revised in terms of the new forecast period) of 97.6 billion cubic feet. This difference is due primarily to the difference in population forecasts. Although the Board's population forecast is higher than recent municipal census figures indicate for 1958 and 1959, the Board is reluctant to make any downward adjustment in view of the present outlook for continued economic expansion in the area.

With regard to industrial requirements, Dr. Harries has forecast total consumption equal to 433.6 billion cubic feet as compared to the Board's 1958 estimate of 482.6 billion cubic feet. In view of the evidence submitted by other interested parties at the hearing the Board considered it

advisable to give careful consideration to the adequacy of its 1958 forecast.

Subsequent to the hearing, two members of the Board's staff visited all of the major industrial consumers of gas in the Medicine Hat-Redcliff area and obtained first hand knowledge regarding their plans for expansion and their estimated requirements for the next five years. The possibility of new industries locating in the area was discussed with local representatives and officials of the Provincial Department of Industries and Development.

A new forecast of industrial requirements to 1965 was then prepared based upon the survey results and past data for non surveyed plants. This forecast was then extended to 1989 by trending individual plant requirements to 1970 and thereafter applying per capita consumption rates to the population estimate. Commencing in 1965 provision was made for further new industries being located in the Medicine Hat-Redcliff area. The new forecast of industrial requirements is given in Table C-3 and results in a total industrial requirement of 527.6 billion cubic feet as compared with the Board's 1958 estimate of 482.6 billion cubic feet and Dr. Harries' present estimate of 433.6 billion cubic feet.

The Board's revised estimate of the total gas requirements for the Medicine Hat-Recliff area for the period 1960-1989 inclusive is some 625.2 billion cubic feet. This can be compared with Dr. Harries' estimate of 511.8 billion cubic feet and to the previous Board estimate amended to allow for

the advancement of the forecast period, of 579.9 billion cubic feet. A detailed comparison of Dr. Harries' estimate and the revised Board estimate for the period 1960-1989 inclusive is provided in Table C-3.

Gas Requirements of the Province

Comparison of Estimates and Actual Consumption in 1959.

A comparison by provincial areas of the preliminary gas consumption figures for 1959 with the requirements forecasted by the Board in September 1958 is presented below:

	Domestic Bcf		Commercial Bcf		Industrial Bcf		Total Bcf	
Area	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Tributary to CWNG System	16.3	16.1	9.9	9.6	17.3	15.7	43.5	41.4
Tributary to NUL System	16.9	16.9	14.7	13.2	38.4	34.2	70.0	64.3
Peace River	0.9	0.6	0.7	0.5	1.6	1.3	3.2	2.4
Medicine Hat-Redcliff	1.2	1.2	0.8	0.6	11.0	10.4	13.0	12.2
Remainder of Province	2.6	2.6	1.6	1.5	13.4	14.8	17.6	18.9
	37.9	37.4	27.7	25.4	81.7	76.4	147.3	139.2

(a) Requirements as estimated in September 1958.

(b) Preliminary consumption figures adjusted for degree days and 1,000 Btu per cubic foot heating value.

Consumption in 1959 is expected to be below the forecast made in the 1958 report by approximately 5.5 per cent. A similar difference between actual consumption and estimates was apparent for 1958.

Practically all of this difference relates to the commercial and industrial categories. While most of this difference may have been due to general business conditions, the Board recognizes that industrial requirements, especially in the Canadian Western and Northwestern Utilities areas, may have been predicted on a somewhat optimistic basis.

Requirements of the Canadian Western Area.

The Board's analysis of the City of Calgary submission indicates that an allowance of approximately 430 billion cubic feet would be required if generation of electrical power by gas did become economic. The Board has reviewed this possible requirement in terms of its original forecast for the Calgary area. These estimates, with the revised data for the new forecast period, are as follows:

Classification	1959-1988 Bcf	1960-1989 Bcf
Domestic	633.3	649.5
Commercial	375.5	385.5
Industrial		
Basic Industrial	243.9	250.7
Special Industrial	209.2	209.6
Allowance for New Industrial	483.0	509.0
Total Industrial	936.1	969.3
Total Calgary Metropolitan Area	1,944.9	2,004.3

The Board's forecast for the 1960-1989 period includes an allowance for new industrial requirements of 509 billion cubic feet. The Board has carefully considered whether this provision should be increased in order to provide for the possible generation of electrical energy by gas. The Board decided not to make such an increase because of the many uncertainties related to power generation by gas, the fact that actual industrial consumption in both the Canadian Western and the Northwestern Utilities areas has fallen short of estimates by approximately 10 per cent, and the existence of an integrated gas supply grid system in the Province. With regard to the latter, the Board believes that in future the Calgary area will be served to an increasing extent through the facilities of the Alberta Gas Trunk Line. In view of all these considerations, therefore, the Board is satisfied that the estimates provide an adequate allowance for the generation of electrical power from gas in the Calgary area should it ever be warranted.

The Board's March, 1959 report estimated total gas requirements of 2,370.9 billion cubic feet for the area tributary to the Canadian Western Natural Gas system for the period January 1, 1959 to December 31, 1988. This forecast has been amended by advancing the period by one year, thus increasing the total requirements to 2,434.3 billion cubic feet.

Requirements of the Northwestern Utilities Area.

The Board did not receive any new evidence regarding gas requirements for the area tributary to the Northwestern Utilities system. The Board has compared actual consumption to the original estimated requirements during the last two years and has concluded that there is no real basis for changing the original forecast. In order to avoid amending the total requirements for the Province the Board has arbitrarily reduced the forecast for the Northwestern Utilities area by 45 billion cubic feet in order to allow for an increase in estimated requirements of the Medicine Hat-Redcliff area. In this report the Northwestern Utilities area has been expanded to include the Lloydminster area which was previously included in the "Remainder of the Province". This change is responsible for increasing the estimated gas requirements in the Northwestern Utilities area by 79 billion cubic feet and reducing the Remainder of the Province by a similar amount.

Requirements of other Provincial Areas.

The Board did not receive any further information regarding requirements in other provincial areas. The Board has reviewed the estimates contained in the 1958 and 1959 reports and has concluded that there is no need to amend this forecast. The Board has found it expedient to sub-divide the remainder of the Province into three areas, namely the Wabamun-Hinton Area, the North part of the Province and the South part of the Province. Details with regard to the estimated requirements of each of these areas are provided in Table C-6.

Total Requirements.

Based upon a comparison of actual consumption and estimated requirements as contained in the 1958 report, the Board believes that the original forecast of total requirements for the Province remains valid. The only adjustment that has been made to the original forecast pertains to the advancement of the forecast period by one year. The Board's forecast of gas requirements for the period January 1, 1960 to December 31, 1989 is 8,417 billion cubic feet. Details of total annual gas requirements for domestic, commercial and industrial purposes are provided in Table C-5. The estimated annual and peak day requirements for the various provincial areas are contained in Table C-6. Details of the break down of the requirements for the remainder of the Province are shown in Table C-7.

Present Export Commitments

Details of the withdrawals of gas authorized under the existing export permits are presented below.

The Alberta and Southern Gas Co. Ltd. Permit AS-59-1, the Trans-Canada Pipe Lines Limited Permit TC-59-2 and the Westcoast Transmission Company Limited Permit WC-59-3 have been added since the 1958 report. To date there have not been any gas withdrawals from the Province under the terms of these permits.

	Maximum Daily MMcf	Maximum Annual Bcf	Total Authorized Withdrawal Bcf	Withdrawn to June 30, 1959 Bcf	Remaining Authorized Withdrawal Bcf
Peace River Transmission Company Limited	6.0	0.6	13.0	4.2	8.8
Peace River Transmission Company Limited	7.0	1.0	20.0	2.1	17.9
Westcoast Transmission Company Limited and Westcoast Transmission Company (Alberta) Ltd.	190.0	56.0	1,080.0	53.6	1,026.4
Westcoast Transmission Co. Ltd.(WC-59-3)	165.0	54.0	800.0	-	800.0
Canadian-Montana Pipeline Company	100.0	20.0	359.9*	79.6	280.3*
Saskatchewan Power Corporation	83.0	18.0	223.0	1.8	221.2
Trans-Canada Pipe Lines Ltd. (TC-54-1)	650.0	225.0	4,550.0	63.5	4,486.5
Trans-Canada Pipe Lines Ltd. (TC-59-2)	210.0	70.0	1,320.0	-	1,320.0
Alberta and Southern Gas Co. Ltd. (AS-59-1)	400.0	135.0	2,300.0	-	2,300.0
Total	1,811.0	579.6	10,665.9	204.8	10,461.1

* All gas from Black Butte, Comrey, Manyberries, Pendant D'Oreille and Smith Coulee fields. Reserves in these fields are presently estimated at 280.3 billion cubic feet.

Note: The above figures are at 14.4 psia and at 60°F and have not been converted to a common 1,000 Btu per foot basis.

TABLE C - 1

OIL AND GAS CONSERVATION BOARD

CALGARY METROPOLITAN AREA

ESTIMATED POPULATION AND ELECTRICAL ENERGY REQUIREMENTS

1958 - 1989

	POPULATION		PER CAPITA CONSUMPTION			ELECTRICAL ENERGY REQUIREMENTS		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	(000's)		KWH's			B KWH's		
YEAR	CITY (A)	BOARD (B)	CITY (C)	CWNG (C)	BOARD	CITY	CWNG (D)	BOARD
1958	236	230	2093	2093	2196	0.494	0.494	0.494
1959	251	240	2251	2251	2354	0.565	0.565	0.565
1960	270	257	2400	2400	2530	0.650	0.650	0.650
1961	278	269	2680	2520	2730	0.750	0.700	0.730
1962	287	280	3000	2610	2970	0.860	0.750	0.830
1963	295	291	3350	2710	3210	0.990	0.800	0.930
1964	303	303	3630	2810	3450	1.100	0.850	1.050
1965	313	315	3830	2910	3690	1.200	0.910	1.160
1966	323	327	4090	3030	3930	1.320	0.980	1.290
1967	332	338	4367	3163	4114	1.450	1.050	1.390
1968	342	347	4678	3274	4298	1.600	1.120	1.490
1969	352	358	4972	3409	4482	1.750	1.200	1.610
1970	363	369	5317	3526	4666	1.930	1.280	1.720
1971	374	380	5695	3663	4850	2.130	1.370	1.840
1972	385	390	6104	3818	5030	2.350	1.470	1.960
1973	397	399	6549	3955	5210	2.600	1.570	2.080
1974	409	409	6968	4107	5390	2.850	1.680	2.210
1975	421	420	7458	4275	5570	3.140	1.800	2.340
1976	433	430	7968	4434	5750	3.450	1.920	2.470
1977	446	441	8520	4619	5920	3.800	2.060	2.610
1978	460	452	9130	4783	6090	4.200	2.200	2.750
1979	474	463	9750	4979	6260	4.600	2.360	2.900
1980	488	475	10451	5164	6430	5.100	2.520	3.050
1981	503	487	11133	5368	6600	5.600	2.700	3.200
1982	518	496	11776	5579	6770	6.100	2.890	3.360
1983	533	506	12758	5797	6940	6.800	3.090	3.510
1984	549	516	13661	6011	7110	7.500	3.300	3.670
1985	566	527	14664	6254	7280	8.300	3.540	3.840
1986	583	537	15609	6518	7450	9.100	3.800	4.000
1987	600	548	16667	6750	7634	10.000	4.050	4.180
1988	618	559	17799	7006	7818	11.000	4.330	4.370
1989	637	570	19000	7220	8000	12.100	4.600	4.600
TOTAL REQUIREMENTS 1960 - 1989 INCLUSIVE						124.320	61.540	71.790

(A) YEAR-END POPULATION.

(B) MID-YEAR POPULATION.

(C) ANNUAL PER CAPITA CONSUMPTION CALCULATED USING CITY'S POPULATION ESTIMATE AND RESPECTIVE ESTIMATES OF TOTAL ELECTRICAL ENERGY REQUIREMENTS.

(D) ANNUAL ELECTRICAL ENERGY REQUIREMENTS PROJECTED AT 7 PER CENT PER YEAR INCREASE COMMENCING IN 1961.

TABLE C - 2

OIL AND GAS CONSERVATION BOARD

CALGARY METROPOLITAN AREA

ESTIMATED DEMAND AND SUPPLY OF ELECTRICAL ENERGY

1960 - 1989

	Demand B Kwh's			Supply B Kwh's				Gas Required by Local Gas-Fired Power Plant * Bcf		
1	2	3	4	5	6	7	8	9	10	11
				Calgary	Local Gas-Fired Power Plant					
Year	City	CWNG	Board	Power	City	CWNG	Board	City	CWNG	Board
1960	0.65	0.65	0.65	0.65	-	-	-	-	-	-
1961	0.75	0.70	0.73	0.75	-	-	-	-	-	-
1962	0.86	0.75	0.83	0.86	-	-	-	-	-	-
1963	0.99	0.80	0.93	0.99	-	-	-	-	-	-
1964	1.10	0.85	1.05	1.10	-	-	-	-	-	-
1965	1.20	0.91	1.16	1.18	0.02	-	-	0.3	-	-
1966	1.32	0.98	1.29	1.18	0.14	-	0.11	1.8	-	1.38
1967	1.45	1.05	1.39	1.18	0.27	-	0.21	3.4	-	2.63
1968	1.60	1.12	1.49	1.18	0.42	-	0.31	5.3	-	3.88
1969	1.75	1.20	1.61	1.18	0.57	0.02	0.43	7.1	0.3	5.37
1970	1.93	1.28	1.72	1.18	0.75	0.10	0.54	9.4	1.3	6.75
1971	2.13	1.37	1.84	1.18	0.95	0.19	0.66	11.9	2.4	8.25
1972	2.35	1.47	1.96	1.18	1.17	0.29	0.78	14.6	3.6	9.75
1973	2.60	1.57	2.08	1.18	1.42	0.39	0.90	17.8	4.9	11.25
1974	2.85	1.68	2.21	1.18	1.67	0.50	1.03	20.9	6.3	12.88
1975	3.14	1.80	2.34	1.18	1.96	0.62	1.16	24.5	7.8	14.50
1976	3.45	1.92	2.47	1.18	2.27	0.74	1.29	28.4	9.3	16.13
1977	3.80	2.06	2.61	1.18	2.62	0.88	1.43	32.8	11.0	17.88
1978	4.20	2.20	2.75	1.18	3.02	1.02	1.57	37.8	12.8	19.63
1979	4.60	2.36	2.90	1.18	3.42	1.18	1.72	42.8	14.8	21.50
1980	5.10	2.52	3.05	1.18	3.92	1.34	1.87	49.0	16.8	23.38
1981	5.60	2.70	3.20	1.18	4.42	1.52	2.02	55.3	19.0	25.25
1982	6.10	2.89	3.36	1.18	4.92	1.71	2.18	61.5	21.4	27.25
1983	6.80	3.09	3.51	1.18	5.62	1.91	2.33	70.3	23.9	29.13
1984	7.50	3.30	3.67	1.18	6.32	2.12	2.49	79.0	26.5	31.13
1985	8.30	3.54	3.84	1.18	7.12	2.36	2.66	89.0	29.5	33.25
1986	9.10	3.80	4.00	1.18	7.92	2.62	2.82	99.0	32.8	35.25
1987	10.00	4.05	4.18	1.18	8.82	2.87	3.00	110.3	35.9	37.50
1988	11.00	4.33	4.37	1.18	9.82	3.15	3.19	122.8	39.4	39.88
1989	12.10	4.60	4.60	1.18	10.92	3.42	3.42	136.5	42.8	42.75
Total	124.32	61.54	71.79		90.47	28.95	38.12	1,131.5	362.5	476.55

* Converted to natural gas equivalent on basis of 1 Kwh = 12.5 cubic feet.

TABLE C - 3

OIL AND GAS CONSERVATION BOARD

MEDICINE HAT - REDCLIFF AREA

COMPARISON OF ESTIMATES OF POPULATION AND

GAS REQUIREMENTS

1960 - 1989

	POPULATION		GAS REQUIREMENTS							
	MID YEAR (1000's)		DOMESTIC BCF		COMMERCIAL BCF		INDUSTRIAL BCF		TOTAL REQUIREMENTS BCF	
YEAR	HARRIES	BOARD	HARRIES	BOARD	HARRIES	BOARD	HARRIES	BOARD	HARRIES	BOARD
1960	24.5	26.5	1.2	1.2	.5	.8	11.4	11.3	13.1	13.3
1961	25.2	27.5	1.3	1.3	.6	.8	11.6	11.7	13.5	13.8
1962	25.8	28.6	1.3	1.3	6	.9	11.7	12.0	13.6	14.2
1963	26.5	29.7	1.3	1.4	.6	.9	12.0	12.3	13 9	14 6
1964	27.1	30.9	1.4	1.4	.7	9	12.1	12.6	14.2	14.9
1965	27.8	32.1	1.4	1.5	.7	1.0	12.3	13.5	14.4	16.0
1966	28.5	33.4	1.4	1.6	.7	1.0	12.6	13.8	14.7	16.4
1967	29.2	34.4	1.5	1 6	.7	1.0	12.8	14.1	15 0	16.7
1968	30.0	35.4	1.5	1.7	.8	1.0	13.0	14.4	15.3	17.1
1969	30.7	36.5	1.5	1.7	.8	1.0	13.2	14.8	15.5	17.5
1970	31.5	37.6	1.6	1.8	.8	1.0	13.5	15.6	15.9	18.4
1971	32.3	38.7	1.6	1.8	.8	1.1	13.7	15.9	16.1	18.8
1972	32.9	39.9	1.6	1.9	.8	1.1	13.9	16.3	16.3	19.3
1973	33.6	41.1	1.7	1.9	.8	1.1	14.1	16.6	16.6	19.6
1974	34.2	42.3	1.7	2.0	.9	1.2	14.3	17.0	16.9	20.2
1975	34.9	43.6	1.7	2.1	.9	1.2	14.5	18.0	17.1	21.3
1976	35.6	44.9	1.8	2.1	.9	1.2	14.7	18.2	17.4	21.5
1977	36.3	46.0	1.8	2.2	.9	1.3	14.9	18.6	17.6	22.1
1978	37.0	47.1	1.9	2.2	.9	1.3	15.1	18.9	17.9	22.4
1979	37.8	48.3	1.9	2.3	1.0	1.3	15.3	19.2	18.2	22.8
1980	38.5	49.5	1.9	2.4	1.0	1.4	15.6	20.2	18.5	24.0
1981	39.3	50.7	2.0	2.4	1.0	1.4	15.8	20.5	18.8	24.3
1982	40.1	51.9	2.0	2.5	1.0	1.4	16.0	20.9	19.0	24.8
1983	40.9	53.2	2.0	2.5	1.0	1.5	16.3	21.2	19.3	25.2
1984	41.7	54.5	2.1	2.6	1.0	1.5	16.5	21.6	19.6	25.7
1985	42.6	55.8	2.1	2.7	1.1	1.5	16.8	22.7	20.0	26.9
1986	43.4	57.0	2.2	2.7	1.1	1.6	17.0	23.0	20.3	27.3
1987	44 3	58.4	2.2	2.8	1.1	1.6	17.3	23.6	20.6	28.0
1988	45.2	59.9	2.3	2.8	1.1	1.7	17.6	24.2	21,0	28.7
1989	46.1	61.4	2.4	2.8	1.1	1.7	18.0	24.9	21.5	29.4
TOTAL			52.3	61.2	25.9	36.4	433.6	527.6	511.8	625.2

NOTES: THE FIGURES SHOWN UNDER HARRIES ARE TAKEN FROM EXHIBIT 6 AND ADJUSTED TO COVER THE PERIOD JAN. 1, 1960 TO DEC. 31, 1989.

TABLE C - 4

OIL AND GAS CONSERVATION BOARD

ESTIMATE OF GAS REQUIREMENTS

PROVINCE OF ALBERTA, JANUARY 1, 1960 - DECEMBER 31, 1989

(QUANTITIES ARE BASED ON NORMAL DEGREE DAYS AND ADJUSTED TO 1,000 BTU VALUE PER CUBIC FOOT)

1	2	3	4	5
YEAR	DOMESTIC BILLIONS OF CUBIC FEET	COMMERCIAL BILLIONS OF CUBIC FEET	INDUSTRIAL BILLIONS OF CUBIC FEET	TOTAL BILLIONS OF CUBIC FEET
1960	40.5	29.3	91.1	160.9
1961	43.3	31.0	101.1	175.4
1962	45.9	32.3	106.9	185.1
1963	47.5	33.9	113.1	194.5
1964	49.3	35.4	119.3	204.0
1965	51.2	37.0	125.9	214.1
1966	53.2	37.8	132.8	223.8
1967	54.5	38.8	139.8	233.1
1968	55.8	39.6	147.0	242.4
1969	57.1	40.6	154.8	252.5
1970	58.8	41.4	162.6	262.8
1971	59.9	42.4	170.8	273.1
1972	60.9	43.2	173.8	277.9
1973	62.0	44.0	176.7	282.7
1974	63.0	44.7	179.8	287.5
1975	64.1	45.5	182.8	292.4
1976	65.1	46.2	185.7	297.0
1977	66.3	47.0	189.0	302.3
1978	67.4	47.9	192.2	307.5
1979	68.5	48.7	195.3	312.5
1980	69.8	49.5	198.8	318.1
1981	71.0	50.3	202.1	323.4
1982	72.0	51.1	205.5	328.6
1983	73.3	52.0	209.1	334.4
1984	74.6	52.9	212.6	340.1
1985	75.8	53.8	216.3	345.9
1986	77.2	54.7	219.8	351.7
1987	78.4	55.6	223.5	357.5
1988	79.8	57.0	227.5	364.3
1989	81.0	58.2	231.9	371.1
TOTAL	1,887.2	1,341.8	5,187.6	8,416.6

TABLE C - 5

OIL AND GAS CONSERVATION BOARD

ESTIMATE OF GAS REQUIREMENTS

PROVINCE OF ALBERTA, JANUARY 1, 1960 - DECEMBER 31, 1989

ALLOCATION BETWEEN AREAS TRIBUTARY TO THE DISTRIBUTING SYSTEM

(QUANTITIES ARE BASED ON NORMAL DEGREE DAYS AND ADJUSTED TO 1,000 BTU VALUE PER CUBIC FOOT)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	AREA TRIBUTARY TO CWNG SYSTEM			AREA TRIBUTARY TO NUL SYSTEM			PEACE RIVER AREA			MEDICINE HAT - REDCLIFF AREA			REMAINDER OF THE PROVINCE			TOTAL PROVINCIAL REQUIREMENTS		
YEAR	ANNUAL BILLIONS OF CUBIC FEET	PEAK DAY MMCF	LOAD FACTOR PER CENT	ANNUAL BILLIONS OF CUBIC FEET	PEAK DAY MMCF	LOAD FACTOR PER CENT	ANNUAL BILLIONS OF CUBIC FEET	PEAK DAY MMCF	LOAD FACTOR PER CENT	ANNUAL BILLIONS OF CUBIC FEET	PEAK DAY MMCF	LOAD FACTOR PER CENT	ANNUAL BILLIONS OF CUBIC FEET	PEAK DAY MMCF	LOAD FACTOR PER CENT	ANNUAL BILLIONS OF CUBIC FEET	PEAK DAY MMCF	LOAD FACTOR PER CENT
1960	47.1	314	41	79.1	470	46	3.8	26	40	13.3	52	70	17.6	86	56	160.9	948	46
1961	51.3	335	42	86.6	505	47	4.2	28	41	13.8	54	70	19.5	92	58	175.4	1,014	47
1962	54.4	355	42	91.6	523	48	4.4	29	41	14.2	56	70	20.5	118	48	185.1	1,081	47
1963	57.2	373	42	96.7	552	48	4.7	31	41	14.6	57	70	21.3	133	44	194.5	1,146	47
1964	60.0	390	42	102.1	583	48	5.1	34	41	14.9	58	70	21.9	139	43	204.0	1,204	47
1965	63.1	412	42	106.9	610	48	5.7	38	41	16.0	63	70	22.4	143	43	214.1	1,266	47
1966	65.6	418	43	111.8	638	48	6.3	41	42	16.4	64	70	23.7	150	43	223.8	1,311	47
1967	68.3	435	43	116.4	665	48	6.8	44	42	16.7	65	70	24.9	159	43	233.1	1,368	47
1968	70.7	449	43	120.9	676	49	7.2	47	42	17.1	67	70	26.5	167	43	242.4	1,406	47
1969	73.1	466	43	126.1	704	49	7.4	48	42	17.5	68	70	28.4	181	43	252.5	1,467	47
1970	76.0	484	43	130.5	731	49	7.7	50	42	18.4	72	70	30.2	188	43	262.8	1,525	47
1971	78.5	489	44	135.7	759	49	8.2	52	43	18.8	74	70	31.9	201	43	273.1	1,575	47
1972	79.8	496	44	138.1	756	50	8.5	54	43	19.3	75	70	32.2	203	43	277.9	1,584	48
1973	81.5	507	44	140.1	768	50	9.0	57	43	19.6	77	70	32.5	205	43	282.7	1,614	48
1974	82.8	516	44	142.5	780	50	9.4	60	43	20.2	79	70	32.6	206	43	287.5	1,641	48
1975	84.1	524	44	144.4	792	50	9.8	62	43	21.3	83	70	32.8	207	43	292.4	1,668	48
1976	85.5	519	45	146.9	804	50	10.1	63	44	21.5	84	70	33.0	208	43	297.0	1,678	48
1977	87.0	530	45	149.6	820	50	10.4	65	44	22.1	86	70	33.2	210	43	302.3	1,711	48
1978	88.6	539	45	152.2	834	50	10.8	67	44	22.4	88	70	33.5	212	43	307.5	1,740	48
1979	90.0	548	45	154.7	848	50	11.1	69	44	22.8	89	70	33.9	214	43	312.5	1,768	48
1980	91.6	556	45	156.7	858	50	11.5	71	44	24.0	94	70	34.3	217	43	318.1	1,796	48
1981	93.2	567	45	159.4	874	50	11.8	72	45	24.3	95	70	34.7	219	43	323.4	1,827	48
1982	94.6	576	45	161.9	888	50	12.3	75	45	24.8	97	70	35.0	221	43	328.6	1,857	48
1983	96.5	588	45	164.7	902	50	12.6	77	45	25.2	99	70	35.4	225	43	334.4	1,891	48
1984	98.0	595	45	167.6	918	50	12.8	78	45	25.7	100	70	36.0	228	43	340.1	1,919	48
1985	99.7	607	45	169.8	930	50	13.2	80	45	26.9	105	70	36.3	230	43	345.9	1,952	48
1986	101.3	617	45	172.7	946	50	13.4	82	45	27.3	107	70	37.0	235	43	351.7	1,987	48
1987	103.0	627	45	175.6	962	50	13.5	82	45	28.0	110	70	37.4	238	43	357.5	2,019	48
1988	104.9	637	45	178.8	980	50	13.9	84	45	28.7	112	70	38.0	242	43	364.3	2,055	48
1989	106.9	651	45	182.0	998	50	14.4	88	45	29.4	115	70	38.4	245	43	371.1	2,097	48
TOTAL	2,434.3			4,162.1			280.0			625.2			915.0			8,416.6		

TABLE C - 6

OIL AND GAS CONSERVATION BOARD

- ESTIMATE OF GAS REQUIREMENTS -

REMAINDER OF PROVINCE, JANUARY 1, 1960 - DECEMBER 31, 1989

(QUANTITIES ARE BASED ON NORMAL DEGREE DAYS AND ADJUSTED TO 1,000 BTU VALUE PER CUBIC FOOT)

1	2			3			4			5		
YEAR	REMAINDER NORTHERN ALBERTA			REMAINDER SOUTHERN ALBERTA			WABAMUN-HINTON			REMAINDER OF THE PROVINCE		
	Annual Billions of Cubic Feet	Peak Day MMCF	Load Factor Per Cent	Annual Billions of Cubic Feet	Peak Day MMCF	Load Factor Per Cent	Annual Billions of Cubic Feet	Peak Day MMCF	Load Factor Per Cent	Annual Billions of Cubic Feet	Peak Day MMCF	Load Factor Per Cent
1960	2.8	22	35	1.4	13	30	13.4	51	72	17.6	86	56
1961	3.4	27	35	1.6	15	30	14.5	50	80	19.5	92	58
1962	5.7	45	35	3.8	35	30	11.0	38	80	20.5	118	48
1963	7.3	57	35	4.0	37	30	10.0	39	70	21.3	133	44
1964	7.7	60	35	4.0	36	30	10.2	43	65	21.9	139	43
1965	7.7	60	35	4.3	39	30	10.4	44	65	22.4	143	43
1966	8.2	62	36	4.8	43	30	10.7	45	65	23.7	150	43
1967	8.9	66	37	5.1	47	30	10.9	46	65	24.9	159	43
1968	9.9	71	38	5.4	49	30	11.2	47	65	26.5	167	43
1969	10.9	77	39	6.1	56	30	11.4	48	65	28.4	181	43
1970	12.0	82	40	6.5	56	32	11.7	50	65	30.2	188	43
1971	12.7	88	40	7.3	63	32	11.9	50	65	31.9	201	43
1972	12.9	89	40	7.4	64	32	11.9	50	65	32.2	203	43
1973	12.8	88	40	7.5	65	32	12.2	52	65	32.5	205	43
1974	12.8	88	40	7.6	66	32	12.2	52	65	32.6	206	43
1975	12.8	88	40	7.8	67	32	12.2	52	65	32.8	207	43
1976	12.8	88	40	7.9	68	32	12.3	52	65	33.0	208	43
1977	12.9	89	40	8.0	69	32	12.3	52	65	33.2	210	43
1978	13.0	90	40	8.2	70	32	12.3	52	65	33.5	212	43
1979	13.2	91	40	8.3	71	32	12.4	52	65	33.9	214	43
1980	13.4	92	40	8.4	72	32	12.5	53	65	34.3	217	43
1981	13.6	93	40	8.5	73	32	12.6	53	65	34.7	219	43
1982	13.8	94	40	8.6	74	32	12.6	53	65	35.0	221	43
1983	14.0	96	40	8.7	75	32	12.7	54	65	35.4	225	43
1984	14.3	98	40	8.9	76	32	12.8	54	65	36.0	228	43
1985	14.4	99	40	9.0	77	32	12.9	54	65	36.3	230	43
1986	14.7	101	40	9.2	79	32	13.1	55	65	37.0	235	43
1987	15.0	103	40	9.3	80	32	13.1	55	65	37.4	238	43
1988	15.3	105	40	9.5	81	32	13.2	56	65	38.0	242	43
1989	15.6	107	40	9.6	82	32	13.2	56	65	38.4	245	43
TOTAL	344.5			206.7			363.8			915.0		

APPENDIX D

THE MEETING OF PRESENT AND FUTURE REQUIREMENTS OF ALBERTA, THE PRESENT EXPORT COMMITMENTS AND ADDITIONAL REQUIREMENTS OF THE APPLICANTS

None of the applicants presented evidence to demonstrate a complete method whereby the present and future requirements of the Province could be met from the presently established reserves. Either directly or by inference Trans-Canada, Alberta and Southern and Westcoast expressed agreement with the illustrative schedules prepared by the Board in its March, 1959, report. Each of the applicants presented illustrative schedules to demonstrate the manner in which the additional quantities of gas, for which they were applying, could be produced from reserves which they considered surplus to Alberta's requirements.

The Board has made a thorough analysis of the illustrative schedules submitted by the applicants and has re-assessed the overall problem of the meeting of the present and future requirements of Alberta, the present export commitments and the additional requirements of the applicants. The Board has found it convenient to employ the "formula" method developed and previously employed in the September, 1958, and March, 1959, reports. This method leads to results which the Board is confident are comparable to those obtainable through more detailed deliverability schedules. The formula method was not employed (except for checking purposes) in the case of the markets to be supplied from the Medicine Hat and Etzikom Fields

due to the unusual complexities and the different periods of years of the markets to be served.

The formula method has been discussed in detail in both Appendix E of the September, 1958, report and Appendix D of the March, 1959, report. For convenience, however, a summary of the equations used in the method are presented here. A modification to that portion of the formula dealing with reserves necessary to meet peak day requirements is explained.

Cumulative Future Annual Requirements

The annual requirements for the i^{th} year, A_i, is

$$A_i = A_1 (1 + g/100)^{i-1}$$

where A_1 = known annual requirement of the first or present year, and

g = effective annual growth rate, per cent.

The cumulative future annual requirement, A_1S, is

$$\overset{n}{A}_1 = A_1 \sum (1 + g/100)^{i-1} = A_1 S$$

where n = number of future years

S = summation factor

The summation factor, S, may be evaluated by binomial expansion and summation for any selected values of n and g. An evaluation of the summation factor appears in Figure D-1 for growth rates from 0 to 10 per cent per year and n values from twenty to thirty years.

Future Peak Day Requirement

The future peak day requirement, in the n^{th} year, P_n, is related to the annual requirement A_n through the load factor X_n.

Thus $P_n = A_n/365X_n = (A_1/365X_n)\ (1 + g/100)^{n-1}$

$= (A_1/365X_n)\ Y$

Where Y = peak ratio factor.

The peak ratio factor, Y, may be evaluated for selected values of n and g. Figure D-2 presents the values of Y for growth rates from 0 to 10 per cent per year and n values from twenty to thirty years.

The use of an effective constant growth rate, under circumstances where it is anticipated that the growth rate actually will decline, leads to a terminal year peak somewhat higher than would be obtained from a year to year projection. The ratio of the peak anticipated on a year to year declining growth basis to that calculated on an effective constant growth basis has been found to be close to 0.8. (This is a revision of the 0.7 figure previously used). Introducing this correction,

$$P_n = (0.8A_1/365X_n)\ Y$$

Reserves Needed For Future Peak

The factors influencing the amount of deliverability which may be developed economically per unit of reserves are cost of drilling, well spacing and reservoir conditions. In the September, 1958, and March, 1959, reports use was made of the reserve-delivery ratio, F, defined as the ratio of the remaining disposable reserves to the deliverability available from those reserves. It was found that for the fields or integrated groups of fields assumed as sources of supply, F

varied from approximately 1 to approximately 4.5 billion cubic feet per million cubic feet per day.

In reviewing its previous work and as a result of further analyses in connection with this report, the Board has concluded that the numerical value and the method of application of the reserve-delivery ratio has led to an unnecessary or excessive degree of protection for the terminal year peak day. This has resulted from the fact that the method, as previously applied, did not give full weight to the contribution to the terminal year deliverability of the gas which would be left in the reservoir at the time of the abandonment of a field. (This fact has also been drawn to the Board's attention recently by engineers of some of the export companies).

The Board now recognizes that a more realistic way of determining the gas required to meet terminal year deliverability is

1. to determine the gas in the reservoir or gas in place (expressed in terms of equivalent pipe line gas) needed to meet the terminal year peak by evaluating FP_n, and
2. to convert the gas in place to the equivalent established or disposable gas by subtracting the gas which will be left in the reservoir at abandonment conditions. This may be effected by applying to the total gas in place the reservoir recovery factor which, for Alberta fields, lies in the range of 0.75 to 0.90.

The above procedure is without serious assumption when applied to a single field. For a group or a composite of fields, however, the effective reserve-delivery ratio is greater than that obtained by dividing the total of the reserves by the total of the deliverabilities. The amount by which the effective ratio exceeds that calculated from totals varies depending upon the size and the individual ratios of the component fields. Test calculations have indicated that the effective ratio is of the order of 1.3 times that calculated as the ratio of the totals.

Total Reserve Needed for Future Requirements

The total reserve needed for future requirements for a period of n years, R_n, may be calculated through the following formula:

$$R_n = (A_1S + 1.3F(0.8A_1/365X_n)Y)\ K$$

$$= KA_1(S + 1.04FY/365X_n)$$

or say $$R_n = KA_1(S + FY/365X_n)$$

The quantities needed for the calculation are

A_1 = the annual requirement of the first or present year in billions of cubic feet,

n = the number of future years to be considered,

g = the effective growth rate, per cent per year,

X_n = the load factor of the n^{th} year, fraction,

F = the reserve-delivery ratio = ratio of reserves of gas in the reservoir (corrected to equivalent pipe line volumes) to its attributable deliverability, billion cubic feet per million cubic feet,

K = reservoir recovery factor=ratio of disposable pipe line gas to the equivalent pipe line gas in the reservoir,

and Figures D-1 and D-2 provide the value of S and Y directly.

Allocation of Present and Future Established Reserves in Meeting Requirements

Additional data have been obtained since the last report, confirming and strengthening the previous conclusions with respect to the reliability of forecasting the growth of gas reserves in Alberta. These data have been reviewed and analyzed in Appendix B and lead to the conclusion that even on a pessimistic forecast reserve growth of about 2.2 trillion cubic feet per year may be expected with confidence. The Board believes that average reserve growth at this rate for the next few years may be counted upon with as much reliability as presently established reserves. Having this in mind the Board concludes that there is no reason not to rely upon such assured growth, for say two to five years, when considering the problem of meeting the last few years of Alberta's thirty-year annual and peak day requirements. The Board has taken the 2.2 trillion cubic feet (low) estimate of reserve growth over a two-year period, leading to 4.4 trillion cubic feet, and assumed it would be available for meeting the final years of the future requirements of the Province.

The reliance being placed on growth in reserves is consistent with that done in the September, 1958, report,

but the Board believes that the present method of relating the proportion of the protection based on future reserves to the actual growth figures is more realistic.

In the case of the Medicine Hat area, however, in view of the historical growth of industry based on the availability of natural gas and in view of its relative isolation from other fields, the Board considers it proper to provide for the protection of the thirty-year requirements entirely from the presently established gas reserves in the area.

Future Alberta Requirements and Needed Reserves

The computations and results of the formula estimates of Alberta's future gas requirements and needed reserves are presented in Table D-1. The estimates are subdivided by provincial marketing areas. Columns 2 and 3 of the table show the 1960 annual requirements and the 1960 peak day requirements respectively. The effective rate of growth of the requirements over the thirty-year period is shown in column 4. The growth rates of column 4 and the terminal year load factors in column 5 result in overall requirements which are in close agreement with those shown in Appendix C. Column 6 shows the reserve-delivery ratio, F, accumulated for the various supply areas in the manner previously described.

It will be noted that the use of "gas in place" instead of "disposable gas" in the calculation of F results in higher reserve-delivery ratios than those contained in the corresponding tables of the two previous reports. There is an

exception in the case of the Medicine Hat area where recent successes with hydraulic fracturing of representative wells has improved the delivery characteristics of the Medicine Hat Field resulting in a lower ratio.

Column 7 gives the summation factors for thirty years taken from Figure D-1 for the growth rates of column 4. Column 8 shows the total annual requirements for the future thirty-year period. These are essentially the same as those shown in Appendix C. The peak day factors, Y, for thirty years are shown in column 9. The factors are determined from Figure D-2 for the growth rate of column 4. The thirtieth year peak day requirement is shown in column 10. The reserve of gas in place (pipe line equivalent volume) needed to meet the terminal year peak is shown in column 11. These volumes are obtained from the multiplication of columns 6, 10 and the adjustment factor of 1.3. Column 12, being the total of columns 8 and 11, indicates the total reserve of gas in place (pipe line equivalent volume) needed to meet both the annual and the peak day requirements for a thirty-year period. Column 13 shows the reservoir recovery factor or the ratio of disposable pipe line gas to pipe line gas in place for the composites of fields supplying each of the marketing areas. The disposable pipe line gas necessary to meet the thirty-year requirements is shown in column 14 and is obtained through the multiplication of columns 12 and 13.

The formula calculations indicate that the annual requirements of Alberta for the next thirty years are 8.39 trillion

cubic feet compared with 8.42 trillion cubic feet estimated in Appendix C. The growth rates employed in Table D-1 were selected to give this agreement. Table D-1 shows that the total reserves needed to protect both the annual and the peak day requirements of Alberta for thirty years are 11.7 trillion cubic feet.

Present Export Commitments, Requirements and Needed Reserves

The future requirements and needed reserves for present export commitments are shown in Table D-2. Columns 2, 3 and 4 of the tabulation indicate the quantities of gas authorized for export, the amount exported to June 30, 1959, and the remaining permit commitment. The terminal date of the permit and the terminal peak day requirement (taken as the maximum daily quantity authorized in the permit), are listed in columns 5 and 6 respectively. Column 7 shows the reserve-delivery ratio, F, considered to be representative of the composites of the various supply fields. Column 8, being the product of columns 6 and 7 and the adjustment factor of 1.3, indicates the reserves of gas in place required for deliverability at the terminal date of the permit. Column 9, being the total of columns 4 and 8, gives the total reserves of pipe line gas in place now needed to meet the committed export volumes. Column 10 indicates the ratio of disposable pipe line gas to pipe line gas in place for the composites of fields supplying each of the export permits. Column 11 shows the volumes of disposable pipe line gas now needed to meet the committed export volumes. It

should be noted that a portion of the volumes shown in column 11 would be available for other requirements after the terminal date of the permits.

The volumes shown in Table D-2 are based on gas having a heating value of 1,000 Btu per cubic foot. The corresponding authorized volumes on the basis of gas as produced are shown in Appendix C.

Recapitulation and Evaluation of Surplus Established Gas

The results from Tables D-1 and D-2, together with an estimate of reserves within economic reach permit an immediate determination of the surplus in established reserves.

Established Reserves within Economic Reach		26.3 Tcf(1)
Required for Alberta	11.7 Tcf	
Less Portion to be Supplied from Future Reserves	4.4 Tcf	
Net Requirements		7.3 Tcf
Required for Existing Permits		13.7 Tcf
Subtotal		21.0 Tcf
Surplus Requirements of Alberta and Existing Export Permits		5.3 Tcf
Total		26.3 Tcf

(1) 1,000 Btu basis

Requirements and Needed Reserves of Present Applicants

Table D-3 contains a computation of the reserves necessary for each of the four applicants in order to meet their total export requirements -- those of subsisting permits plus those covered by the present applications. In the case of

Saskatchewan Power Corporation, the volume shown is that portion of the requested volume which the Board considers could be produced over a twenty-five-year period, the longest period for which the Board is prepared to issue a permit. Column 1 of the table shows the name of the applicant company and the subdivision of its requirements by existing permits (including proposed amendments) and proposed new permits. Column 2 indicates the volumes of gas authorized for export plus the additional quantities requested. Column 3 shows the volumes of gas exported to June 30, 1959, and column 4 the total remaining volumes. Columns 5 and 6 show the terminal dates of the existing and requested permits and the terminal peak day requirements. Columns 7, 8 and 9, in a manner similar to the corresponding columns in Table D-2, give the reserve-delivery ratios for the supply fields, the reserves of pipe line gas in place needed for terminal peak day requirements and the resulting total reserves of pipe line gas in place required for each of the requested permits. Column 10 gives the ratio of disposable pipe line gas to pipe line gas in place and column 11 the corresponding volumes of disposable pipe line gas necessary to meet the total requirements of the applicants. Column 12 indicates the reserves required for the present export commitments. The volumes shown have been obtained from column 11 of Table D-2. Column 13 being the difference between columns 11 and 12 gives the additional reserves necessary to completely satisfy the requirements shown in the present applications.

The table indicates that a total of 3.6 trillion cubic feet of reserves is necessary to meet the additional export requirements covered by the four applications.

Illustrative "Allocation" of Fields to Markets and to Surplus

An illustrative allocation of reserves necessary to meet future requirements of Alberta and present export commitments is shown in Table D-4. The reserve allocation has been made based on the Board's knowledge of existing contractual arrangements and also on its judgment of the suitability of the reserve for the market. Columns 1 and 2 show the fields or composites of fields and their reserves as presented in Table A-1. The details of the composites appear in Table D-7.

Columns 3 to 9 inclusive list reserves for indicated marketing areas, each totalling the needed reserves shown in column 14 of Table D-1. Allocation to each of the Alberta marketing areas has been made from certain fields suitable from a reservoir and geographical point of view and by the transfer of reserves from each of Saskatchewan Power, Trans-Canada, Westcoast and certain reserves not now contracted in the Foothills and Plains Divisions of Alberta Gas Trunk Line. In columns 12 to 19 inclusive are shown the allocations to meet the requirements of existing export permits. Immediately following the totals of gas allocated from established reserves is shown the allocation of the 4.4 trillion cubic feet of gas confidently expected from the growth of reserves over the next two years. Except in the case of the Medicine Hat area where the

thirty-year requirements have been assumed to come entirely from the presently established gas reserves in the area, an arbitrary allocation of the 4.4 trillion cubic feet of "trend" gas has been made on the basis of total requirements of the areas. (The arbitrary nature of the allocation is not considered serious because of the flexibility afforded by the facilities of Alberta Gas Trunk Line). Column 11 of the table indicates by fields or composites the volumes of established reserves surplus to Alberta requirements after the allocations have been made as shown in columns 3 to 10 inclusive. The allocation of reserves to existing export permits is shown in columns 12 to 19 inclusive while column 20 gives the reserves surplus to the requirements of Alberta and existing export permits.

The total shown in each of the Alberta marketing areas and existing export permits agree with those shown in Tables D-1 and D-2. In each case the total is divided to show the gas which would actually be delivered during the period involved and the gas needed or available for protection of the terminal year peak day. The total shows that after providing for local requirements and existing export commitments there is an indicated surplus of some 5.3 trillion cubic feet, confirming in detail the figure presented on page D-10. Including gas which would be available after the termination of the various permits and the thirty-year protection for Alberta, the surplus would be some 10.4 trillion cubic feet.

Table D-5 is an illustrative allocation of reserves necessary to meet the total export requirements, the present commitments and the additional quantities requested in the present applications. Column 2 of Table D-5 is the same as column 11 of Table D-4 and shows volumes of gas totalling some 19.0 trillion cubic feet surplus to Alberta's own requirements. Column 3 shows an allocation of reserves to Alberta and Southern Gas Co. Ltd. from fields listed in Permit AS 59-1 while column 4 shows an allocation of reserves from new fields listed in the Alberta and Southern application. In a similar manner, allocation has been made in columns 5 to 12 inclusive to other existing export commitments or to the requirements contained in the applications of Saskatchewan Power Corporation, Trans-Canada Pipe Lines Limited and Westcoast Transmission Company Limited. Column 13 indicates surplus volumes of gas after the previously mentioned allocations have been made. The table indicates deliveries of gas to Canadian Western Natural Gas Company Limited in the amount of 1,518 billion cubic feet. Of this 156 billion cubic feet is allocated to the Calgary Field covered by the Westcoast Transmission Company WC 59-3 permit, and 1,362 billion cubic feet is allocated to fields within the Foothills Division of Alberta Gas Trunk Line. In a similar manner the table shows the transfer of gas in the total amount of 250 billion cubic feet, 207 billion cubic feet from the area covered by the present permit to the Saskatchewan Power Corporation and 43 billion cubic feet to the area covered by the present permit to Trans-Canada, to the requirements of the

Medicine Hat-Redcliff area. Requirements for the remainder of the Province in the amount of 312 billion cubic feet are shown as being met from the surplus column and considered to come partly from each of the Plains and the Foothills Divisions of The Alberta Gas Trunk Line Company Limited.

Immediately following the totals of each of the columns is shown the reserves necessary to meet the export requirements including the present applications. The difference between the totals of the gas allocated and the reserves necessary to meet the export requirements is shown as surplus. The negative quantities indicated in the case of Alberta and Southern AS 59-1 permit, Alberta and Southern application, Trans-Canada TC 54-1 permit and the Westcoast Peace River permit indicate deficiencies in reserves allocated to meet the respective permits. These deficiencies are considered to be nominal. The final entry in the table indicates the volumes of gas which would be available at the termination of the various export permits.

The table shows that a surplus of 1.7 trillion cubic feet of gas exists after all allocations have been made. In addition there would be available after the termination of the period of protection of Alberta requirements 2.0 trillion cubic feet and after the termination of the export permits some 3.3 trillion cubic feet, for an indicated total surplus of 7 trillion cubic feet.

Meeting Local and Export Requirements of Medicine Hat Area

Mr. H. Lowe on behalf of Saskatchewan Power Corporation presented a detailed deliverability schedule at the Saskatchewan Power Corporation hearing, showing a method of meeting local requirements from the Etzikom and Medicine Hat Fields and the requirements of Saskatchewan Power Corporation from the Medicine Hat Field. His study indicated that thirty years local requirements could be satisfied from the reserves of the Etzikom Field, the Bow Island and Ellis pools of the Medicine Hat Field and the western portion of the Medicine Hat pool of the Medicine Hat Field plus deliveries of some 119 billion cubic feet of gas from the areas covered by the present permits to the Saskatchewan Power Corporation and Trans-Canada.

The Board has adopted the method of allocation employed by Mr. Lowe and presents a similar detailed deliverability schedule as Table D-6. Columns 2, 3 and 4 of that table show the requirements of the Medicine Hat-Redcliff area and have been obtained in the manner described in Appendix C. Totals to meet these requirements from the reserves available from the western part of the Medicine Hat Field, the Etzikom Field and the Bow Island and Ellis composite are shown in columns 5 to 13 inclusive. Columns 14, 15 and 16 indicate the residual requirements of the Medicine Hat-Redcliff area after these deliveries. The requirements of Trans-Canada to be met from the north-eastern part of the Medicine Hat Field are shown in columns 17, 18 and 19. Deliveries to meet the

residual requirements of the Medicine Hat-Redcliff area from that portion of the Medicine Hat Field serving Trans-Canada export requirements are shown in columns 20, 21 and 22. In a similar manner deliveries from that part of the Medicine Hat Field supplying Saskatchewan Power Corporation export requirements are shown in columns 23, 24 and 25. Columns 26, 27 and 28 indicate the volumes of gas surplus in the area serving Saskatchewan Power Corporation and available for export. These volumes have been designed to agree with the requirements indicated by the Saskatchewan Power Corporation application in the earlier years and have been limited by the availability of gas in the later years. The totals indicate that some 585 billion cubic feet of gas (having a heating value of 1,000 Btu per cubic foot) would be available for export in the twenty-five-year period, 1960 to 1984 inclusive.

Drainage Problem

Evidence was presented by Mr. Lowe for the Saskatchewan Power Corporation concerning the migration of gas from the western portion of the area covered by the present permit to Saskatchewan Power Corporation (east half of Range 4) to the Medicine Hat-Redcliff area of the Field. Mr. Lowe's study indicated that a total of some 10 billion cubic feet of gas has migrated since 1945 and that drainage is continuing at a rate of $1\frac{1}{2}$ billion cubic feet per year. Owners of non-producing gas reserves in other parts of the Field also expressed concern at the migration they believed was taking place from their properties. The Board recognizes that

drainage has occurred and will continue unless owners of non-producing tracts find a way to develop their properties and market their gas. The restriction against removal of gas from the East half of Range 4 together with the fact that the City of Medicine Hat has not seen fit to purchase gas from this area has not assisted the problem. The Board believes that so long as adequate protection is made for the requirements of the Medicine Hat-Redcliff area, there is no reason to restrict export in a regional sense. If the Saskatchewan Power Corporation permit is restricted only in the total quantities of gas which may be removed from the field, owners may develop their properties and seek a share of the local and export markets. The Board would hope that this could be done on a voluntary basis but failing a satisfactory solution owners would have recourse under The Oil and Gas Conservation Act.

TABLE D - 1

OIL AND GAS CONSERVATION BOARD

FUTURE ALBERTA GAS REQUIREMENTS AND REQUIRED RESERVES (1000 BTU BASIS)

(1) AREA	(2) 1960 ANNUAL REQUIREMENTS A_1	(3) 1960 PEAK DAY P_1	(4) AVERAGE GROWTH RATE G	(5) TERMINAL YEAR LOAD FACTOR X_N	(6) RESERVE-DELIVERY RATIO F	(7) SUMMATION FACTOR S	(8) FUTURE REQUIREMENTS A_1S	(9) PEAK RATIO FACTOR Y	(10) TERMINAL YEAR PEAK P_N	(11) RESERVE REQUIRED FOR FUTURE PEAK $1.3FP_N$	(12) TOTAL GAS IN PLACE NECESSARY TO MEET 30 YEAR REQUIREMENTS	(13) RATIO OF DISPOSABLE GAS TO GAS IN PLACE K	(14) DISPOSABLE GAS NECESSARY TO MEET 30 YEAR REQUIREMENTS
						30 YEARS		30 YEARS	30 YEARS				
	BCF	MMCFD	PER CENT PER YEAR		BCF PER MMCFD		BCF		MMCFD	BCF	BCF	BCF PER BCF	BCF
Canadian Western Natural Gas Company Limited	47.1	314.0	3.5	45	3.5	51.6	2430	2.72	624	2839	5269	0.87	4584
Northwestern Utilities Limited	79.1	470.0	3.6	50	1.2	52.4	4145	2.80	970	1504	5649	0.78	4406
Medicine Hat	13.3	52.0	2.9	70	3.0	46.9	624	2.55	106	252(1)	876	0.76	665
Peace River	3.8	26.0	5.6	45	1.7	73.8	280	4.87	90	199	479	0.88	422
Wabamun - Hinton	13.4 (10.0)(2)	39.0	1.2	65	2.4	31.6(3)	365(4)	1.37	46	144	509	0.84	428
Remainder of Province (North)	2.8	22.0	8.4	40	2.5	122.0	342	10.36	159	516	858	0.81	695
Remainder of Province (South)	1.4	13.0	9.4	32	2.5	147.0	206	13.52	130	423	629	0.81	509
Provincial Total	157.5	936.0	3.7	48	2.2	53.3	8392	2.87	2125	5877	14269	0.82	11709

(1) Represents $1.0FP_N$, where P_N obtained from Table D-6.

(2) Uniform Growth Rate Assumed to Start in 1963 at 10.0 Bcf.

(3) 27th Year Factor.

(4) Figure represents 49 Bcf plus projection from 4th to 30th year.

TABLE D - 2

OIL AND GAS CONSERVATION BOARD

FUTURE REQUIREMENTS AND REQUIRED RESERVES FOR PRESENT EXPORT COMMITMENTS (1000 BTU BASIS)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
EXPORTING FIRM	AUTHORIZED AMOUNT OF EXPORT	AMOUNT EXPORTED TO JUNE 30, 1959	REMAINING PERMIT COMMITMENT	TERMINAL DATE OF PERMIT	TERMINAL PEAK DAY	RESERVE-DELIVERY RATIO	RESERVES REQUIRED FOR TERMINAL PEAK	TOTAL GAS IN PLACE NECESSARY TO PROTECT TO TERMINAL DATE OF PERMIT	RATIO OF DISPOSABLE GAS TO GAS IN PLACE	DISPOSABLE GAS NEEDED FOR PROTECTION TO TERMINAL DATE OF PERMIT
					P_N	F	$1.3FP_N$		K	
	BCF	BCF	BCF		MMCFD	BCF PER MMCFD	BCF	BCF	BCF PER BCF	BCF
ALBERTA AND SOUTHERN GAS COMPANY PERMIT AS-59-1	2360.0	-	2360.0	FEB. 29, 1984	410	2.0	1066	3426.0	0.90	3083
CANADIAN MONTANA PIPE LINE COMPANY	319.9	73.9	246.0	MAY 13, 1974	-	-	-	-	-	246
SASKATCHEWAN POWER CORPORATION	212.0	1.8	210.2	JULY 1, 1978	79	3.0	237(1)	447.2	0.76	340
TRANS-CANADA PIPE LINES LIMITED PERMIT TC-54-1	4690.0	65.4	4624.6	MAY 14, 1981	670	2.7	2345	6969.6	0.85	5925
TRANS-CANADA PIPE LINES LIMITED PERMIT TC-59-2	1370.0	-	1370.0	MAY 14, 1981	218	1.5	425	1795.0	0.88	1580
PEACE RIVER TRANSMISSION CO. NO. 1 PEACE RIVER TRANSMISSION CO. NO. 2	33.3	6.5	26.8	JULY 13, 1980 OCT. 1, 1976	13	1.7	29	55.8	0.88	49
WESTCOAST (PEACE RIVER PERMIT)	1100.0	53.5	1046.5	DEC. 31,1979	194	1.7	428	1474.5	0.88	1297
WESTCOAST TRANSMISSION CO. LTD. PERMIT WC-59-3	797.0	-	797.0	FEB. 29, 1984	164	2.8	597	1394.0	0.88	1226
TOTAL	10882.2	201.1	10681.1		1748	2.3	5127	15808.1	0.87	13746

(1) REPRESENTS $1.0FP_N$

TABLE D - 3

OIL AND GAS CONSERVATION BOARD

FUTURE REQUIREMENTS AND REQUIRED RESERVES OF APPLICANTS[1] (1000 BTU BASIS)

(1) EXPORTING FIRM	(2) AUTHORIZED AND ADDITIONAL REQUESTED AMOUNT OF EXPORT	(3) AMOUNT EXPORTED TO JUNE 30, 1959	(4) REMAINING AMOUNT OF REQUEST	(5) TERMINAL DATE OF REQUESTED PERMIT	(6) TERMINAL PEAK DAY P_N	(7) RESERVE-DELIVERY RATIO F	(8) RESERVES REQUIRED FOR TERMINAL PEAK $1.3FP_N$	(9) TOTAL GAS IN PLACE REQUIRED TO MEET PERMIT	(10) RATIO OF DISPOSABLE GAS TO GAS IN PLACE K	(11) DISPOSABLE GAS REQUIRED TO MEET PERMIT	(12) RESERVE PRESENTLY COMMITTED	(13) ADDITIONAL RESERVE REQUIRED TO MEET APPLICATION
	BCF	BCF	BCF		MMCFD	BCF PER MMCFD	BCF	BCF	BCF PER BCF	BCF	BCF	BCF
ALBERTA AND SOUTHERN GAS COMPANY PERMIT AS-59-1	3872		3872.0	DEC. 31, 1986	462	2.0	1201	5073.0	0.90	4566.0	3083.0	1483.0
ALBERTA AND SOUTHERN GAS COMPANY ADDITIONAL REQUIREMENTS	428		428.0	DEC. 31, 1986	51	1.6	106	534.0	0.90	480.0	-	480.0
SASKATCHEWAN POWER CORPORATION	587.5[2]	1.8	585.7[2]	DEC. 31, 1984	128	3.0	531[3]	928.0[4]	0.76	705.0	340.0	365.0
TRANS-CANADA PIPE LINES LIMITED PERMIT TC-54-1	4690	65.4	4624.6	MAY 14, 1981	700	2.7	2457	7081.6	0.85	6019.0	5925.0	94.0
TRANS-CANADA PIPE LINES LIMITED PERMIT TC-59-2	1760	-	1760.0	MAY 14, 1981	280	1.5	546	2306.0	0.88	2029.0	1580.0	449.0
TRANS-CANADA PIPE LINES LIMITED ADDITIONAL REQUIREMENTS	380	-	380.0	MAY 14, 1981	64	2.0	166	546.0	0.84	459.0	-	459.0
WESTCOAST TRANSMISSION COMPANY PERMIT WC-59-3	1095		1095.0	FEB. 29, 1984	164	2.8	597	1692.0	0.88	1489.0	1226.0	263.0
TOTAL[5]	12812.5	67.2	12745.3		1849	2.3	5604	18160.6	0.87	15747.0	12154	3593.0

(1) INCLUDES REQUIREMENTS AUTHORIZED UNDER EXISTING PERMITS AND UNDER PRESENT APPLICATIONS.

(2) HAS BEEN AMENDED TO FIT DELIVERABILITY SCHEDULE (TABLE D-6).

(3) REPRESENTS $1.0FP_N$ - WHERE P_N INCLUDES PEAK DELIVERIES TO CITY.

(4) REFERS ONLY TO GAS NECESSARY TO MEET EXPORT REQUIREMENTS.

(5) DOES NOT INCLUDE CANADIAN MONTANA OR PEACE RIVER PERMITS.

TABLE D - 4

OIL AND GAS CONSERVATION BOARD

ILLUSTRATIVE ALLOCATION OF RESERVES NECESSARY TO MEET FUTURE REQUIREMENTS OF ALBERTA AND PRESENT EXPORT COMMITMENTS (1000 BTU BASIS)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
FIELD, POOL OR COMPOSITE	REMAINING DISPOSABLE RESERVES BCF	CANADIAN WESTERN NATURAL GAS AREA BCF	NORTHWESTERN UTILITIES LIMITED AREA BCF	MEDICINE HAT BCF	PEACE RIVER BCF	WABAMUN-HINTON BCF	REMAINDER OF PROVINCE NORTH BCF	REMAINDER OF PROVINCE SOUTH BCF	ALBERTA TOTAL BCF	SURPLUS TO ALBERTA REQUIREMENTS BCF	ALBERTA AND SOUTHERN GAS COMPANY AS-59-1 BCF	CANADIAN MONTANA PIPELINES LIMITED BCF	PEACE RIVER TRANSMISSION COMPANY BCF	SASKATCHEWAN POWER CORPORATION BCF	TRANS-CANADA PIPE LINES LIMITED TC-54-1 BCF	TRANS-CANADA PIPE LINES LIMITED TC-59-2 BCF	WESTCOAST PEACE RIVER BCF	WESTCOAST TRANSMISSION COMPANY WC-59-3 BCF	SURPLUS BCF
STETTLER COMPOSITE	177	104	73						177										
JUMPING POUND	495	495							495										
OKOTOKS	132	132							132										
FOREMOST-BOW ISLAND	39	39							39										
TURNER VALLEY	330	330							330										
CARBON	126	126							126										
EDMONTON OILFIELD COMPOSITE	1282		1084						1084	198									198
EDMONTON DRY GAS COMPOSITE	1399		1175			52			1227	172									172
LLOYDMINSTER	4		4						4										
EDMONTON DEFERRED GAS COMPOSITE	612		330			140			470	142									142
MEDICINE HAT COMPOSITE	1517			415					415	1102				547		144			411
PEACE RIVER COMPOSITE,	1253				252				252	1001			49				952		
ALEXANDER COMPOSITE	66					66			66										
FIELDS UNDER PERMIT AS-59-1	3145									3145	2397								748
HOMEGLEN-RIMBEY	756									756	104				620				32
MINNEHIK-BUCK LAKE	218									218	141								77
WESTEROSE SOUTH	1230									1230	441					449			340
PAKOWI COMPOSITE	273									273		246							27
FIELDS UNDER PERMIT TC-54-1	5236									5236					5236				
FIELDS UNDER PERMIT TC-59-2	1486									1486						1030			456
FIELDS UNDER PERMIT WC-59-3	1671									1671								1382	289
FIELDS INCLUDED IN ALBERTA & SOUTHERN APPLICATION	446									446									446
FIELDS INCLUDED IN TRANS-CANADA PIPE LINES APPLICATION	591									591									591
ALBERTA GAS TRUNK LINE PLAINS DIVISION	753									753									753
ALBERTA GAS TRUNK LINE FOOTHILLS DIVISION	2196									2196									2196
DEFERRED GAS	510									510									510
LOCAL UTILITIES	165						91	74	165										
OTHER SMALL FIELDS	247						134	113	247										
SUB TOTAL	26355	1226	2666	415	252	258	225	187	5229	21126	3083	246	49	547	5856	1623	952	1382	7388
DELIVERIES TO MEET LOCAL REQUIREMENTS																			
ALBERTA GAS TRUNK LINE FOOTHILLS DIVISION		1362							1362	(1362)									(1362)
ALBERTA GAS TRUNK LINE PLAINS DIVISION							190	122	312	(312)									(312)
WESTCOAST TRANSMISSION COMPANY		156							156	(156)								(156)	
EASTERN PORTION OF MEDICINE HAT FIELD				250					250	(250)				(207)		(43)			
TOTAL	26355	2744	2666	665	252	258	415	309	7309	19046	3083	246	49	340	5856	1580	952	1226	5714
RESERVES NECESSARY TO MEET LOCAL AND EXPORT REQUIREMENTS (TABLES D-1 & D-2)		4584	4406	665	422	428	695	509	11709		3083	246	49	340	5925	1580	1297	1226	
GAS AVAILABLE FROM TRENDS		1840	1740	-	170	170	280	200	4400		-	-	-	-	-	-	-	-	
SURPLUS		-	-	-	-	-	-	-	-		-	-	-	-	(69)	-	(345)	-	SURPLUS (414) 5200
GAS DELIVERABLE DURING PERIOD		1455	2510	624	167	220	204	125	5305		2360	246	27	210	4625	1370	1047	797	
SURPLUS AVAILABLE AFTER PERIOD		1289	156	41	85	38	211	184	2004	2004	723	-	22	130	1300	210	250	429	SURPLUS 5066 10368

TABLE D - 5

OIL AND GAS CONSERVATION BOARD

ILLUSTRATIVE ALLOCATION OF RESERVES NECESSARY TO MEET EXPORT APPLICATIONS (1000 BTU BASIS)

(1) FIELD, POOL OR COMPOSITE	(2) SURPLUS TO ALBERTA REQUIREMENTS (TABLE D-4) BCF	(3) ALBERTA AND SOUTHERN GAS COMPANY AS-59-1 BCF	(4) ALBERTA AND SOUTHERN GAS COMPANY APPLICATION BCF	(5) CANADIAN MONTANA PIPE LINES LIMITED BCF	(6) PEACE RIVER TRANSMISSION COMPANY BCF	(7) SASKATCHEWAN POWER CORPORATION BCF	(8) TRANS-CANADA PIPE LINES LIMITED TC-54-1 BCF	(9) TRANS-CANADA PIPE LINES LIMITED TC-59-2 BCF	(10) TRANS-CANADA PIPE LINES LIMITED APPLICATION BCF	(11) WESTCOAST PEACE RIVER PERMIT BCF	(12) WESTCOAST TRANSMISSION COMPANY WC-59-3 BCF	(13) SURPLUS BCF
STETTLER COMPOSITE												
JUMPING POUND												
OKOTOKS												
FOREMOST-BOW ISLAND												
TURNER VALLEY												
CARBON												
EDMONTON OILFIELD COMPOSITE	198											198
EDMONTON DRY GAS COMPOSITE	172											172
LLOYDMINSTER												
EDMONTON DEFERRED GAS COMPOSITE	142											142
MEDICINE HAT COMPOSITE	1102					912		190				-
PEACE RIVER COMPOSITE	1001				49					952		
ALEXANDER COMPOSITE												
FIELDS UNDER PERMIT AS-59-1	3145	3145										
HOMEGLEN-RIMBEY	756	136					620					-
MINNEHIK-BUCK LAKE	218	185							23			10
WESTEROSE SOUTH	1230	580						569				81
PAKOWKI COMPOSITE	273			246								27
FIELDS UNDER PERMIT TC-54-1	5236						5236					-
FIELDS UNDER PERMIT TC-59-2	1486							1319				173
FIELDS UNDER PERMIT WC-59-3	1671										1645	26
FIELDS INCLUDED IN ALBERTA AND SOUTHERN APPLICATION	446		446									
FIELDS INCLUDED IN TRANS-CANADA APPLICATION	591								436			155
ALBERTA GAS TRUNK LINE - PLAINS DIVISION	753											753
ALBERTA GAS TRUNK LINE - FOOTHILLS DIVISION	2196											2196
DEFERRED GAS	510											510
LOCAL UTILITIES												
OTHER SMALL FIELDS												
SUB TOTAL	21126	4046	446	246	49	912	5856	2072	459	952	1645	4443
DELIVERIES TO MEET LOCAL REQUIREMENTS												
CANADIAN WESTERN NATURAL GAS COMPANY LIMITED	(1518)											(1362)
MEDICINE HAT-REDCLIFF	(250)										(156)	(312)
REMAINDER OF PROVINCE	(312)					(207)		(43)				
TOTAL	19046	4046	446	246	49	705	5856	2029	459	952	1489	2769
RESERVES NECESSARY TO MEET EXPORT APPLICATIONS		4566	480	246	49	705	6019	2029	459	1297	1489	
SURPLUS TO REQUIREMENTS	-	(520)	(34)	-	-	-	(163)	-	-	(345)	-	(1062)
GAS DELIVERABLE DURING PERIOD		3872	428	246	27	586	4625	1760	380	1047	SURPLUS 1095	1707
SURPLUS AVAILABLE AFTER PERIOD	2004	694	52	-	22	119	1394	269	79	250	394 SURPLUS	5277 6984

TABLE D - 6

OIL AND GAS CONSERVATION BOARD

ILLUSTRATIVE DELIVERABILITY SCHEDULE TO MEET REQUIREMENTS OF MEDICINE HAT-REDCLIFF AREA AND EXPORT REQUIREMENTS FROM THE MEDICINE HAT FIELD

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
	MEDICINE HAT-REDCLIFF AREA REQUIREMENTS			WESTERN PORTION OF MEDICINE HAT FIELD*			ETZIKOM			BOW ISLAND AND ELLIS COMPOSITE			RESIDUAL REQUIREMENTS			TRANS-CANADA EXPORT REQUIREMENTS			DELIVERIES TO CITY FROM TRANS-CANADA AREA			DELIVERIES TO CITY FROM SASKATCHEWAN POWER CORPORATION			SURPLUS AVAILABLE TO SASKATCHEWAN POWER FOR EXPORT		
YEAR	ANNUAL BCF	PEAK DAY MMCF	L.F. %	ANNUAL BCF	PEAK DAY MMCF	L.F. %	ANNUAL BCF	PEAK DAY MMCF	L.F. %	ANNUAL BCF	PEAK DAY MMCF	L.F. %	ANNUAL BCF	PEAK DAY MMCF	L.F. %	ANNUAL BCF	PEAK DAY MMCF	L.F. %	ANNUAL BCF	PEAK DAY MMCF	L.F. %	ANNUAL BCF	PEAK DAY MMCF	L.F. %	ANNUAL BCF	PEAK DAY MMCF	L.F. %
1960	13.3	52	70	9.3	39.8	64	4.0	12.3	89							5.2	15.4	92							3.3	10.9	83
1961	13.8	54	70	9.4	40.5	63	4.4	13.6	89							6.2	19.0	90							4.7	15.5	83
1962	14.2	56	70	9.5	42.0	62	4.7	14.3	90							6.9	20.9	90							5.1	16.8	83
1963	14.6	57	70	9.5	41.8	62	5.1	15.5	90							7.4	22.3	91							6.7	22.1	83
1964	14.9	58	70	7.4	30.6	66	5.7	17.3	90	1.8	9.9	50				7.4	22.3	91							7.6	25.1	83
1965	16.0	63	70	8.3	35.4	64	6.0	18.3	90	1.7	9.3	50				7.4	22.3	91							9.8	32.3	83
1966	16.4	64	70	8.4	35.4	65	6.3	19.2	90	1.7	9.3	50				7.4	22.3	91							11.1	36.6	83
1967	16.7	65	70	8.6	36.3	65	6.5	20.0	89	1.6	8.8	50				7.4	22.3	91							12.2	40.2	83
1968	17.1	67	70	9.8	40.8	66	5.8	18.1	88	1.5	8.2	50				7.4	22.3	91							12.2	40.2	83
1969	17.5	68	70	11.4	49.0	64	4.6	14.8	85	1.5	8.2	50				7.4	22.3	91							18.1	59.6	83
1970	18.4	72	70	13.6	52.7	71	3.4	11.6	80	1.4	7.7	50				7.4	22.3	91							20.1	66.3	83
1971	18.8	74	70	14.8	57.7	70	2.7	9.2	80	1.3	7.1	50				7.4	22.3	91							21.9	72.4	83
1972	19.3	75	70	17.2	65.2	73	0.8	2.7	80	1.3	7.1	50				7.4	22.3	91							25.5	83.9	83
1973	19.6	77	70	18.0	70.4	72				1.2	6.6	50				7.4	22.3	91							27.2	88.6	84
1974	20.2	79	70	17.5	66.7	72				1.2	6.6	50	1.5	5.7	72	7.4	22.3	91	0.3	1.1	72	1.2	4.6	72	28.0	90.2	85
1975	21.3	83	70	16.5	62.8	72				1.1	6.0	50	3.7	14.2	72	7.4	22.3	91	0.7	2.7	72	3.0	11.5	72	29.0	92.6	86
1976	21.5	84	70	15.4	58.6	72				1.1	6.0	50	5.0	19.4	72	7.4	22.3	91	1.0	3.8	72	4.0	15.6	72	32.0	100.8	87
1977	22.1	86	70	14.4	54.8	72				1.0	5.5	50	6.7	25.7	72	7.4	22.3	91	1.3	4.9	72	5.4	20.8	71	34.0	104.8	89
1978	22.4	88	70	13.3	51.3	71				1.0	5.5	50	8.1	31.2	71	7.4	22.3	91	1.6	6.2	71	6.5	25.0	71	35.1	108.1	89
1979	22.8	89	70	12.4	47.9	71				0.9	4.9	50	9.5	36.2	71	7.4	22.3	91	1.9	7.3	71	7.6	28.9	71	37.0	112.3	90
1980	24.0	94	70	11.6	44.8	71				0.9	4.9	50	11.5	44.3	71	3.2	9.7	90	2.3	8.8	71	9.2	35.5	71	38.5	117.2	90
1981	24.3	95	70	10.9	42.0	71				0.8	4.4	50	12.6	48.6	71				2.5	9.7	71	10.1	38.9	71	40.0	121.9	90
1982	24.8	97	70	10.2	39.4	71				0.8	4.4	50	13.8	53.2	71				2.7	10.4	71	11.1	42.8	71	41.6	126.8	90
1983	25.2	99	70	9.5	36.7	71				0.7	3.9	50	15.0	58.4	71				3.0	11.6	71	12.0	46.8	71	43.1	131.2	90
1984	25.7	100	70	9.0	34.7	71				0.7	3.9	50	16.0	61.4	71				3.2	12.4	71	12.8	49.0	71	41.9	127.7	90
1985	26.9	105	70	8.4	32.4	71				0.7	3.9	50	17.8	68.7	71				3.5	13.5	71	14.3	55.2	71			
1986	27.3	107	70	7.7	30.1	70				0.6	3.3	50	19.0	73.6	70				3.8	14.9	70	15.2	58.7	70			
1987	28.0	110	70	7.3	28.6	70				0.6	3.3	50	20.1	78.1	70				4.0	15.6	70	16.1	62.5	70			
1988	28.7	112	70	1.3	5.1	70				0.6	3.3	50	26.8	103.6	70				5.2	20.3	70	21.6	83.3	70			
1989	29.4	115	70							0.6	3.3	50	28.8	111.7	70				5.7	22.3	70	23.1	89.4	70			
TOTAL	625.2			321.0			60.0			28.3			215.9			147.3			42.7			173.2			585.7		
ESTABLISHED RESERVES AVAILABLE FOR DISPOSITION				321.0			60.0			34.0						147.3			42.7			207.0			705.0		
PER CENT WITHDRAWN				100			100			83.2						100			100			83.8			83.4		

* W½ OF RANGE 4, AND RANGES 5, 6 AND 7.

L.F. - LOAD FACTOR

TABLE D - 7

OIL AND GAS CONSERVATION BOARD

DETAILS OF COMPOSITES OF TABLES D-4 AND D-5

NAME OF COMPOSITE	NAME OF FIELD
STETTLER COMPOSITE	ERSKINE
	FENN-BIG VALLEY
	HACKETT
	RICH
	STETTLER
EDMONTON OILFIELD COMPOSITE	ACHESON
	ACHESON EAST
	BONNIE GLEN
	CAMPBELL-NAMAO
	GLEN PARK
	LEDUC-WOODBEND
	PEMBINA
	REDWATER
	SAMSON
	WIZARD LAKE
EDMONTON DRY GAS COMPOSITE	BEAVERHILL LAKE
	BIG LAKE
	BITTERN LAKE
	COOKING LAKE
	DYBERG
	FAIRYDELL-BON ACCORD
	FORT SASKATCHEWAN
	HERCULES
	HOLBORNE
	JASPER PLACE
	KEYSTONE
	KNELLER
	LEGAL
	LILY
	MORINVILLE
	PONOKA
	ST. ALBERT
	TELFORDVILLE
	VIKING-KINSELLA
	WAINWRIGHT
	WESTLOCK
	WILDMERE
EDMONTON DEFERRED GAS COMPOSITE	EXCELSIOR
	JOARCAM (ASSOCIATED GAS)
	LEDUC-WOODBEND (ASSOCIATED D-3)
	PIGEON LAKE
	WESTEROSE
MEDICINE HAT COMPOSITE	ETZIKOM
	MEDICINE HAT
PEACE RIVER COMPOSITE	BELLOY
	BRAEBURN
	BURNT RIVER
	EAGLESHAM
	GORDONDALE
	HAMELIN CREEK
	HEART RIVER
	HIGH PRAIRIE
	NORMANDVILLE
	POUCE COUPE
	POUCE COUPE SOUTH
	RYCROFT
	SADDLE HILLS
	STURGEON LAKE SOUTH
	TANGENT
	WHITELAW
	WOKING

TABLE D-7 (CONT)

NAME OF COMPOSITE	NAME OF FIELD
ALEXANDER COMPOSITE	ALEXANDER (INCLUDES CALAHOO)
	CHIP LAKE
	OBED
FIELDS UNDER PERMIT AS-59-1	BEAVER CREEK
	BERLAND RIVER
	CARSON CREEK
	CARSON CREEK NORTH
	CROSSFIELD
	LOVETT RIVER
	PADDLE RIVER
	PARKLAND
	PINE CREEK
	SARCEE
	STOLBERG
	WATERTON
	WILDCAT HILLS
	WINDFALL
PAKOWKI COMPOSITE	ADEN
	BLACK BUTTE
	COMREY
	MANYBERRIES
	PAKOWKI LAKE
	PENDANT D'OREILLE
	SMITH COULEE
FIELDS UNDER PERMIT TC-54-1	ATLEE-BUFFALO
	BINDLOSS
	CESSFORD
	COUNTESS
	DUCHESS
	GILBY
	HAMILTON LAKE
	KESSLER
	NEVIS
	OYEN
	PINCHER CREEK
	PRINCESS
	PROVOST
	SIBBALD
FIELDS UNDER PERMIT TC-59-2	CARSTAIRS
	HUSSAR
	PREVO
	WAYNE-ROSEDALE
FIELDS UNDER PERMIT WC-59-3	CALGARY
	SAVANNA CREEK
FIELDS INCLUDED IN ALBERTA AND SOUTHERN APPLICATION	BRAZEAU RIVER
	BURNT TIMBER
	CAROLINE
	FOX CREEK
	FOX CREEK NORTH
	FOX CREEK WEST
	KAYBOB
	LOBSTICK
FIELDS INCLUDED IN TRANS-CANADA APPLICATION	CHIGWELL
	ENCHANT
	GRASSY ISLAND LAKE
	THREE HILLS CREEK
	WIMBORNE
	WOOD RIVER

TABLE D - 7 (CONT)

NAME OF COMPOSITE	NAME OF FIELD
PLAINS DIVISION - ALBERTA GAS TRUNK LINE	ANTELOPE
	ANTELOPE NORTH
	ALIX
	BELLSHILL LAKE
	CLIVE
	CASSILS
	CONNORSVILLE
	CONTROL
	ESTHER
	GHOST PINE
	GEM NORTH
	GRAINDALE
	INNISFAIL
	JENNER
	JOFFRE
	LONE PINE CREEK
	MEDICINE RIVER
	NEAPOLIS
	OLDS
	PENHOLD
	REDLAND
	ROSEBUD
	SYLVAN LAKE
	TURIN
FOOTHILLS DIVISION - ALBERTA GAS TRUNK LINE	BERLAND RIVER
	BLUE RIDGE
	CHRISTMAS CREEK
	GARRINGTON
	GOODWIN LAKE
	HARMATTAN-ELKTON
	HARMATTAN-EAST
	JUDY CREEK
	LOOKOUT BUTTE
	SWAN HILLS
	SUNDRE
	TWO CREEKS
	VIRGINIA HILLS
	WESTWARD HO
DEFERRED GAS	BONNIE GLEN (ASSOCIATED D-3)
	GOLDEN SPIKE
LOCAL UTILITIES	ATHABASCA
	ATHABASCA EAST
	BONNYVILLE
	BROOKS-TILLEY
	BROOKS NORTH-EAST
	COLD LAKE
	DOWLING LAKE
	DUVERNAY
	ELK POINT
	HAIRY HILL
	LAC LA BICHE
	LEHURST
	LINDBERGH
	OBERLIN
	ST. PAUL
	SUFFIELD
	WATTS

TABLE D - 7 (CONT)

NAME OF COMPOSITE	NAME OF FIELD
OTHER SMALL FIELDS	ASHMONT
	CASTOR
	CRAIG LAKE
	DAYSLAND
	DUHAMEL
	DUHAMEL SOUTH
	EDWAND
	HALLIDAY
	HANNA
	HUGHENDON
	IRRICANA
	LEAHURST NORTH
	MALMO
	MAZEPPA
	MELLOWDALE
	NEW NORWAY
	PLAIN LAKE
	RANFURLY
	ROLLING HILLS
	SPEDDEN
	WATER GLEN
	WEST DRUMHELLER
	WILDUNN CREEK
	WILLINGDON

FIGURE D-1

SUMMATION FACTORS 20th TO 30th YEARS FOR AVERAGE GROWTH RATES OF 0 TO 10 PER CENT PER YEAR

PROVINCE OF ALBERTA
OIL AND GAS CONSERVATION BOARD

DECEMBER, 1959

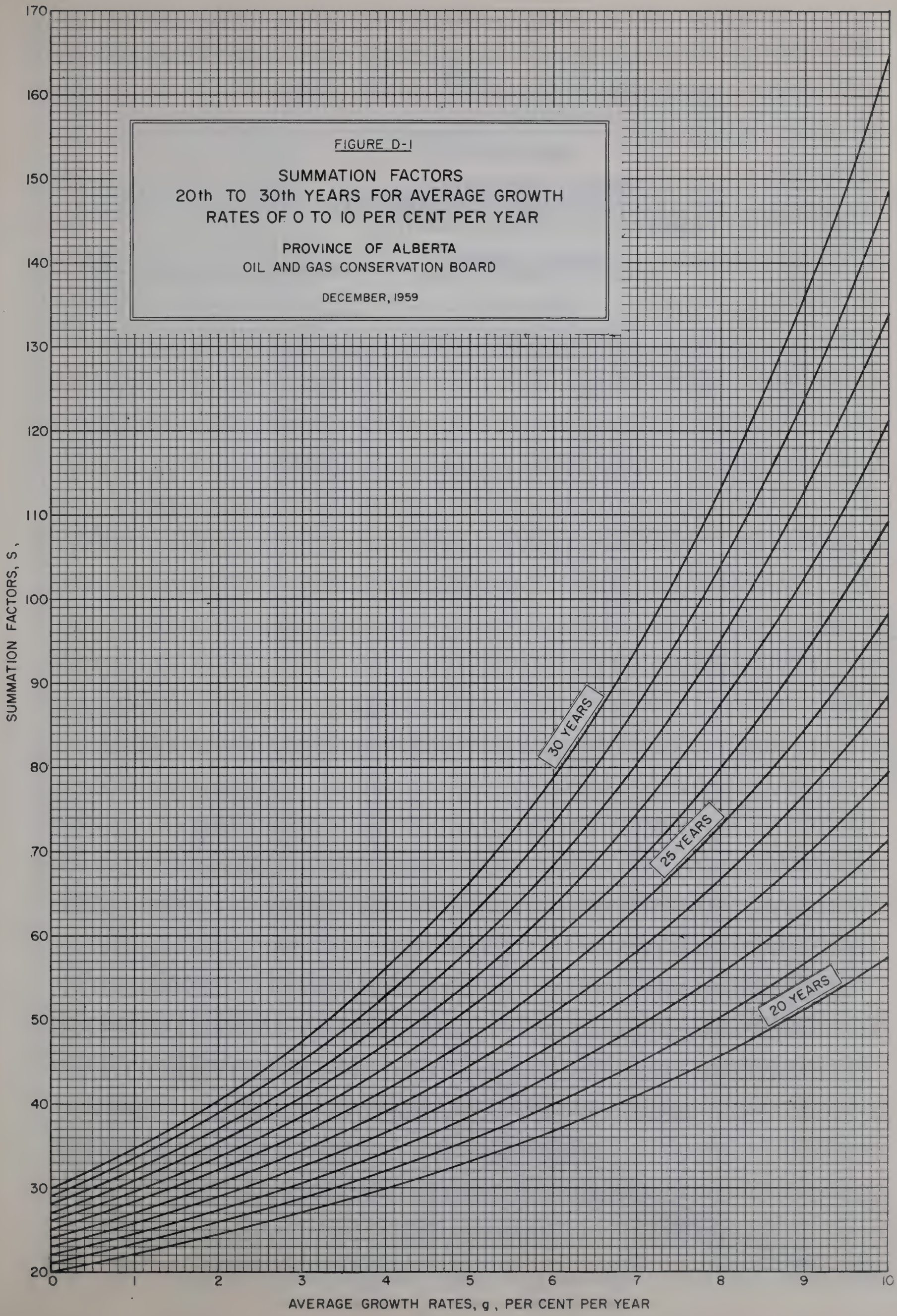
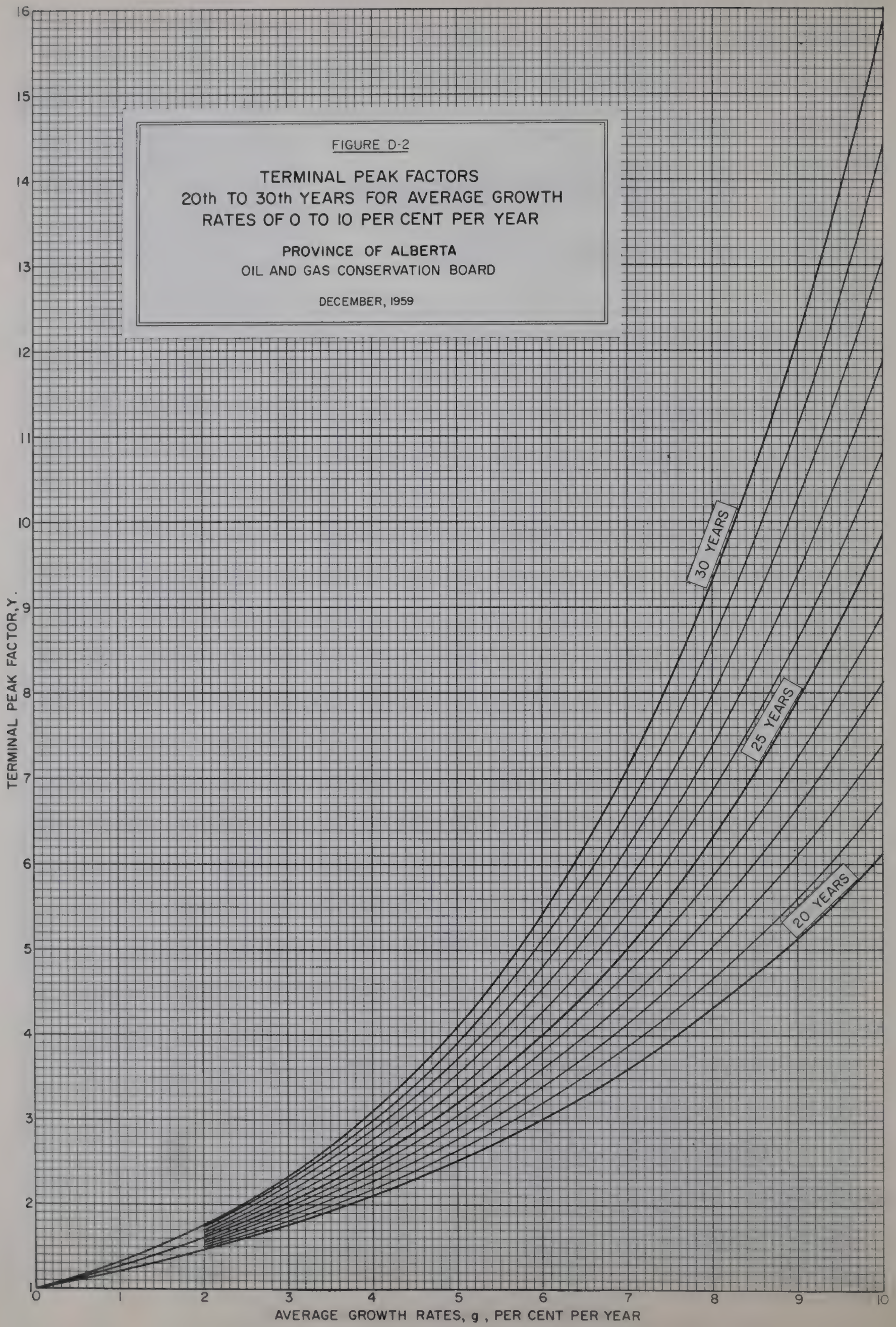


FIGURE D-2

TERMINAL PEAK FACTORS
20th TO 30th YEARS FOR AVERAGE GROWTH RATES OF 0 TO 10 PER CENT PER YEAR

PROVINCE OF ALBERTA
OIL AND GAS CONSERVATION BOARD

DECEMBER, 1959



APPENDIX E

FORMS OF AMENDMENTS AND PERMIT - TRANS-CANADA PIPE LINES LIMITED

This appendix includes:

1. Form of Amendment of Trans-Canada Permit No. TC 54-1
2. Form of Amendment of Trans-Canada Permit No. TC 59-2
3. Form of new Permit.

1. FORM OF AMENDMENT OF TRANS-CANADA PERMIT NO. TC 54-1

IN THE MATTER of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956; and

IN THE MATTER of an application of Trans-Canada Pipe Lines Limited to vary and amend the provisions of Permit No. TC 54-1.

AMENDMENT OF PERMIT NO. TC 54-1

The Oil and Gas Conservation Board, pursuant to section 12 of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956, having publicly heard the application in the City of Calgary, in the Province of Alberta, at a hearing commencing on October 13, 1959, having regard to its own knowledge and its responsibility under the Act, and the Lieutenant Governor in Council having given his approval by Order in Council numbered O.C. and dated , hereby orders as follows:

1. Permit No. TC 54-1, dated the 14th day of May, A.D. 1954, and amended from time to time, granted under The Gas Resources

Preservation Act to Trans-Canada Pipe Lines Limited by The Petroleum and Natural Gas Conservation Board, is further amended.

2. Clause 4 of the terms and conditions of the said Permit is struck out and the following is substituted:

"4. The quantity of gas that may be removed from the Province pursuant to this Permit shall not be more than 680,000,000 cubic feet of gas in any one day, nor more than 225,000,000,000 cubic feet of gas in any consecutive twelve-month period, nor more than 4,550,000,000,000 cubic feet of gas during period of the Permit; the above quantities all being referred to a 14.4 pounds per square inch absolute pressure base and a 60 degree Fahrenheit temperature base.".

MADE at the City of Calgary, in the Province of Alberta, this day of , A.D. 19 .

OIL AND GAS CONSERVATION BOARD,

G. W. Govier,

Deputy Chairman.

2. FORM OF AMENDMENT OF TRANS-CANADA PERMIT NO. TC 59-2

IN THE MATTER of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956; and

IN THE MATTER of an application of Trans-Canada Pipe Lines Limited to vary and amend the provisions of Permit No. TC 59-2.

AMENDMENT OF PERMIT NO. TC 59-2

The Oil and Gas Conservation Board, pursuant to section 12 of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956, having publicly heard the application in the City of Calgary, in the Province of Alberta, at a hearing commencing on October 13, 1959, having regard to its own knowledge and its responsibility under the Act, and the Lieutenant Governor in Council having given his approval by Order in Council numbered O.C. and dated , hereby orders as follows:

1. Permit No. TC 59-2, dated the 29th day of January, A.D. 1959, and amended from time to time, granted under The Gas Resources Preservation Act, 1956, to Trans-Canada Pipe Lines Limited by the Oil and Gas Conservation Board, is further amended.

2. The first paragraph of the preamble to the said Permit is amended by striking out the words "to serve its immediately contractable Canadian requirements outside Alberta".

3. Clause 2 of the terms and conditions of the said Permit is struck out and the following is substituted:

"2. The quantity of gas that may be removed from the Province pursuant to this Permit shall be not more than 270,000,000 cubic feet of gas in any one day, nor more than 90,000,000,000 cubic feet of gas in any consecutive twelve-month period, nor more than 1,700,000,000,000 cubic feet of gas during the term of the Permit.".

MADE at the City of Calgary, in the Province of Alberta, this day of ,A.D. 19 .

OIL AND GAS CONSERVATION BOARD,

G. W. Govier,

Deputy Chairman.

3. FORM OF NEW PERMIT

IN THE MATTER of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956; and

IN THE MATTER of a Permit to Trans-Canada Pipe Lines Limited authorizing the removal of gas from the Province.

PERMIT NO. TC 60-3

WHEREAS the Oil and Gas Conservation Board, upon inquiry into and hearing of an application by Trans-Canada Pipe Lines Limited (herein called "the Permittee"), has found that the applicant is a person who has entered into contracts to purchase gas within the Province and who intends to cause such gas to be removed from the Province and that the provisions of the said Act affecting the application have been complied with; and

WHEREAS the Board is of the opinion that the granting of this Permit for the removal of gas from the Province is in the public interest having regard to the present and future needs

of persons within the Province, and to the established reserves and trends in growth and discovery of the reserves of gas in the Province; and

WHEREAS the Lieutenant Governor in Council has given his approval by Order in Council numbered O.C. and dated

THEREFORE, the Oil and Gas Conservation Board, pursuant to the provisions of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956, hereby grants a Permit to Trans-Canada Pipe Lines Limited, and hereby authorizes the removal of gas from the Province, subject to the regulations and orders made pursuant to the provisions of the said Act and to the terms and conditions prescribed in this Permit as follows:

1. Subject to the conformity of the Permittee with the terms and conditions hereof, this Permit shall be operative for a term commencing on the date hereof and ending on May 14, 1981.

2. The quantity of gas that may be removed from the Province pursuant to this Permit shall be not more than 60,000,000 cubic feet of gas in any one day, nor more than 20,000,000,000 cubic feet of gas in any consecutive twelve-month period, nor more than 355,000,000,000 cubic feet of gas during the term of the Permit.

3. The Permittee, for the purpose of this Permit, may purchase or otherwise acquire for removal from the Province,

and there may be removed from the Province under the authority of this Permit, only gas produced from the pools, fields and areas set out in the following schedule:

SCHEDULE OF POOLS, FIELDS AND AREAS

Chigwell

Enchant

Sedalia

Wimborne

Wood River

Minnehik-Buck Lake

Three Hills Creek

4. The effective commencement of the removal of gas from the Province pursuant to this Permit shall be on or before December 31, 1960, unless upon application by the Permittee a later date is stipulated by the Board.

5. The Permittee shall remove or cause to be removed pursuant to this Permit only such gas as is delivered to it through facilities of The Alberta Gas Trunk Line Company Limited at the interconnection of their pipe lines in the North-east quarter of Section 11, Township 20, Range 1, West of the Fourth Meridian.

6. (1) All gas removed from the Province pursuant to this Permit shall be measured by the Permittee by a master meter approved by the Board and located at the point at which gas is delivered by The Alberta Gas Trunk Line Company Limited to the Permittee.

(2) The specific gravity and higher heating value of all gas received by the Permittee through the facilities of The

Alberta Gas Trunk Line Company Limited shall be measured by the Permittee at the point of receipt.

(3) The measurements required by this clause shall be made in a manner approved by the Board and shall be reported monthly in a manner approved by the Board.

7. Nothwithstanding the provisions of any contract for the purchase or other acquisition of gas, the Board may require the extraction of any substance or substances except methane from any gas before its removal from the Province pursuant to this Permit.

8. The Permittee will supply gas from The Alberta Gas Trunk Line Company Limited pipe line at a reasonable price to any community or consumer within the Province that is willing to take delivery of gas at a point on the pipe line, and that, in the opinion of the Board, can reasonably be so supplied by the Permittee.

9. If any community or consumer is willing to take delivery of gas pursuant to clause 8 of these terms and conditions and agreement on the price to be paid for the gas cannot be reached, the price to be paid shall be determined by the Board of Public Utility Commissioners on the application of an interested party, and the part of the price attributable to transportation shall be based on the assumption that the gas has been supplied from the capable source or sources available to the Permittee nearest to the point of delivery.

10. Subject to section 14 of the said Act, all quantities of gas for the purpose of this Permit shall be referred to a 14.4 pounds per square inch absolute pressure base and a 60 degree Fahrenheit temperature base.

11. Nothwithstanding the provisions hereof, Trans-Canada Pipe Lines Limited shall comply with the provisions of any Act, competent regulation, order or direction governing the drilling for, the production, conservation, gathering, transportation, processing, purchasing, acquisition, sale, measurement, reporting, testing, supply or delivery of gas within the Province.

MADE at the City of Calgary, in the Province of Alberta, this day of , A.D. 19 .

OIL AND GAS CONSERVATION BOARD,

G. W. Govier,

Deputy Chairman.

APPENDIX F

FORMS OF AMENDMENT AND PERMIT - ALBERTA AND SOUTHERN GAS CO. LTD.

This appendix includes:

1. Form of Amendment of Alberta and Southern Permit No. AS 59-1

2. Form of new Permit.

1. FORM OF AMENDMENT OF ALBERTA AND SOUTHERN PERMIT NO. AS 59-1

IN THE MATTER of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956; and

IN THE MATTER of an application of Alberta and Southern Gas Co. Ltd. to vary and amend the provisions of Permit No. AS 59-1.

AMENDMENT OF PERMIT NO. AS 59-1

The Oil and Gas Conservation Board, pursuant to section 12 of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956, having publicly heard the application in the City of Calgary, in the Province of Alberta, at a hearing commencing on October 22, 1959, having regard to its own knowledge and its responsibility under the Act, and the Lieutenant Governor in Council having given his approval by Order in Council numbered O.C. and dated , hereby orders as follows:

1. Permit No. AS 59-1, dated the 7th day of April, A.D.

1959, granted under The Gas Resources Preservation Act, 1956, to Alberta and Southern Gas Co. Ltd. by the Oil and Gas Conservation Board, is amended.

2. Clause 1 of the terms and conditions of the said Permit is struck out and the following is substituted:

"1. Subject to the conformity of the Permittee with the terms and conditions hereof, this Permit shall be operative for a term commencing on the date hereof and ending twenty-five years from the date of the first removal of gas from the Province pursuant to this Permit or October 31, 1986, whichever is sooner.".

3. Clause 2 of the terms and conditions of the said Permit is struck out and the following is substituted:

"2. The quantity of gas that may be removed from the Province pursuant to this Permit shall be not more than 450,000,000 cubic feet of gas in any one day, nor more than 151,200,000,000 cubic feet of gas in any consecutive twelve-month period, nor more than 3,780,000,000,000 cubic feet of gas during the term of the Permit.".

MADE at the City of Calgary, in the Province of Alberta, this day of , A.D. 19 .

OIL AND GAS CONSERVATION BOARD,

G. W. Govier,
Deputy Chairman.

2. FORM OF NEW PERMIT

IN THE MATTER of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956; and

IN THE MATTER of a Permit to Alberta and Southern Gas Co. Ltd. authorizing the removal of gas from the Province.

PERMIT NO. AS 60-2

WHEREAS the Oil and Gas Conservation Board, upon inquiry into and hearing of an application by Alberta and Southern Gas Co. Ltd. (herein called "the Permittee"), has found that the applicant is a person who has entered into contracts to purchase gas within the Province and who intends to cause such gas to be removed from the Province and that the provisions of the said Act affecting the application have been complied with; and

WHEREAS the Board is of the opinion that the granting of this Permit for the removal of gas from the Province is in the public interest having regard to the present and future needs of persons within the Province, and to the established reserves and trends in growth and discovery of the reserves of gas in the Province; and

WHEREAS the Lieutenant Governor in Council has given his approval by Order in Council numbered O.C. and dated .

THEREFORE, the Oil and Gas Conservation Board, pursuant

to the provisions of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956, hereby grants a Permit to Alberta and Southern Gas Co. Ltd., and hereby authorizes the removal of gas from the Province, which gas includes gas that is the property of the Permittee at the time of removal and gas that has been sold by the Permittee to Canadian-Montana Pipe Line Company prior to the removal, subject to the regulations and orders made pursuant to the provisions of the said Act and to the terms and conditions prescribed in this Permit as follows:

1. Subject to the conformity of the Permittee with the terms and conditions hereof, this Permit shall be operative for a term commencing on the date hereof and ending twenty-five years from the date of the first removal of gas from the Province pursuant to this Permit or October 31, 1986, whichever is sooner.

2. The quantity of gas that may be removed from the Province pursuant to this Permit shall be not more than 50,000,000 cubic feet of gas in any one day, nor more than 16,800,000,000 cubic feet of gas in any consecutive twelve-month period, nor more than 420,000,000,000 cubic feet of gas during the term of the Permit.

3. The Permittee, for the purpose of this Permit, may purchase or otherwise acquire for removal from the Province, and there may be removed from the Province under the authority of this Permit, only gas produced from the pools, fields and areas set out in the following schedule:

SCHEDULE OF POOLS, FIELDS AND AREAS

Brazeau River

Burnt Timber

Caroline

Fox Creek

Fox Creek North

Fox Creek West

Kaybob

Lobstick

4. The Permittee shall satisfy the Board prior to March 1st, 1960, that arrangements have been completed for financing the construction of its proposed project and that construction will commence not later than October 1, 1960, unless upon application by the Permittee later dates are stipulated by the Board.

5. The effective commencement of the removal of gas from the Province pursuant to this Permit shall be on or before November 1, 1961, unless upon application by the Permittee a later date is stipulated by the Board.

6. The Permittee shall remove or cause to be removed pursuant to this Permit only such gas as is delivered through the facilities of The Alberta Gas Trunk Line Company Limited

(a) to the pipe line of Alberta Natural Gas Company on behalf of the Permittee, at the interconnection of the said facilities and pipe line at a location

in Section 10, Township 8, Range 5, West of the 5th Meridian and to be approved by the Board, or

(b) to the pipe line of Canadian-Montana Pipe Line Company for sale by the Permittee to Canadian-Montana Pipe Line Company, at the interconnection of the said facilities and pipe line at a location in Township 1, Range 24 or 25, West of the 4th Meridian and to be approved by the Board.

7. (1) All gas removed from the Province pursuant to this Permit shall be measured by the Permittee by master meters approved by the Board and located at the points at which gas is delivered in accordance with clause 6, and in the event that other gas is measured by such a meter, the part of the measured gas that is being removed pursuant to this Permit shall be determined in a manner approved by the Board.

(2) The specific gravity and higher heating value of all gas delivered in accordance with this Permit through the facilities of The Alberta Gas Trunk Line Company Limited shall be measured by the Permittee at the points of delivery.

(3) The measurements required by this clause shall be made in a manner approved by the Board and shall be reported monthly in a manner approved by the Board.

8. Nothwithstanding the provisions of any contract for the purchase or other acquisition of gas, the Board may required the extraction of any substance or substances except methane from any gas before its removal from the Province pursuant

to this Permit.

9. The Permittee will supply gas from The Alberta Gas Trunk Line Company Limited pipe line at a reasonable price to any community or consumer within the Province that is willing to take delivery of gas at a point on the pipe line, and that, in the opinion of the Board, can reasonably be so supplied by the Permittee.

10. If any community or consumer is willing to take delivery of gas pursuant to clause 9 of these terms and conditions and agreement on the price to be paid for the gas cannot be reached, the price to be paid shall be determined by the Board of Public Utility Commissioners on the application of an interested party, and the part of the price attributable to transportation shall be based on the assumption that the gas has been supplied from the capable source or sources available to the Permittee nearest to the point of delivery.

11. Subject to section 14 of the said Act, all quantities of gas for the purpose of this Permit shall be referred to a 14.4 pounds per square inch absolute pressure base and a 60 degree Fahrenheit temperature base.

12. Notwithstanding the provisions hereof, Alberta and Southern Gas Co. Ltd. shall comply with the provisions of any Act, competent regulation, order or direction governing the drilling for, the production, conservation, gathering, transportation, processing, purchasing, acquisition, sale,

measurement, reporting, testing, supply or delivery of gas within the Province.

MADE at the City of Calgary, in the Province of Alberta, this day of , A.D. 19 .

OIL AND GAS CONSERVATION BOARD,

G. W. Govier,

Deputy Chairman.

APPENDIX G

FORM OF AMENDMENT OF SASKATCHEWAN POWER CORPORATION PERMIT

IN THE MATTER of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956; and

IN THE MATTER of an application of Saskatchewan Power Corporation to vary and amend the provisions of the Permit, dated the 30th day of August, A.D. 1957, granted to the said company under The Gas Resources Preservation Act, 1956.

AMENDMENT OF PERMIT

The Oil and Gas Conservation Board, pursuant to section 12 of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956, having publicly heard the application in the City of Medicine Hat, in the Province of Alberta, at a hearing commencing on October 29, 1959, having regard to its own knowledge and its responsibility under the Act, and the Lieutenant Governor in Council having given his approval by Order in Council numbered O.C. and dated , hereby orders as follows:

1. The Permit dated the 30th day of August, A.D. 1957, granted under The Gas Resources Preservation Act, 1956, to Saskatchewan Power Corporation by the Oil and Gas Conservation Board, is amended.

2. The heading "PERMIT" is struck out and the heading "PERMIT NO. SPC 57-1" is substituted.

3. Clause 1 of the terms and conditions of the said Permit is struck out and the following is substituted:

"1. Subject to the conformity of Saskatchewan Power Corporation with the terms and conditions hereof, this Permit shall be operative for a term commencing on July 1, 1958, and ending on December 31, 1984.".

4. Clause 2 of the terms and conditions of the said Permit is struck out and the following is substituted:

"2. The quantity of gas that may be removed from the Province pursuant to this Permit shall be not more than 137,900,000 cubic feet of gas in any one day, nor more than 45,300,000,000 cubic feet of gas in any consecutive twelve-month period, nor more than 620,000,000,000 cubic feet of gas during the term of the Permit.".

5. Clause 3 of the terms and conditions of the said Permit is struck out and the following is substituted:

"3. The permittee, for the purpose of this Permit, may produce, purchase or otherwise acquire for removal from the Province, and there may be removed from the Province under the authority of this Permit, only gas produced from the Medicine Hat Field.".

6. Clause 8 of the terms and conditions of the said Permit is amended by adding immediately at the end thereof the words

"provided, however, that the volume of gas which the permittee may hereby be required to supply to the City of Medicine Hat shall not exceed 182,000,000,000 cubic feet;".

MADE at the City of Calgary, in the Province of Alberta, this day of , A.D. 19 .

OIL AND GAS CONSERVATION BOARD,

G. W. Govier,
Deputy Chairman.

APPENDIX H

FORM OF AMENDMENT OF WESTOCAST TRANSMISSION PERMIT NO. WC 59-3

IN THE MATTER OF The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956; and

IN THE MATTER of an application of Westcoast Transmission Company Limited to vary and amend the provisions of the Permit No. WC 59-3.

AMENDMENT OF PERMIT NO. WC 59-3

The Oil and Gas Conservation Board, pursuant to section 12 of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956, having publicly heard the application in the City of Calgary, in the Province of Alberta, at a hearing on November 16, 1959, having regard to its own knowledge and its responsibility under the Act, and the Lieutenant Governor in Council having given his approval by Order in Council numbered O.C. and dated , hereby orders as follows:

1. Permit No. WC 59-3, dated the 7th day of April, A.D. 1959, granted under The Gas Resources Preservation Act, 1956, to Westcoast Transmission Company Limited by the Oil and Gas Conservation Board, is amended.

2. Clause 2 of the terms and conditions of the said Permit is struck out and the following is substituted:

"2. The quantity of gas that may be removed from the Province pursuant to this Permit shall be not more than

165,000,000 cubic feet of gas in any one day, nor more than 54,000,000,000 cubic feet of gas in any consecutive twelve-month period, nor more than 1,100,000,000,000 cubic feet of gas during the term of the Permit.".

MADE at the City of Calgary, in the Province of Alberta, this day of , A.D. 19 .

OIL AND GAS CONSERVATION BOARD,

G. W. Govier,

Deputy Chairman.

not more than 12,000,000 cubic feet of gas in any one day, nor more than 12,000,000,000 cubic feet of gas in any consecutive twelve-month period, nor more than 1,200,000,000,000 cubic feet of gas during the term of the Permit.

DATED at the City of Calgary, in the Province of Alberta, this day of , A.D. 19 .

OIL AND GAS CONSERVATION BOARD,

E. W. Hurst,

Deputy Chairman.